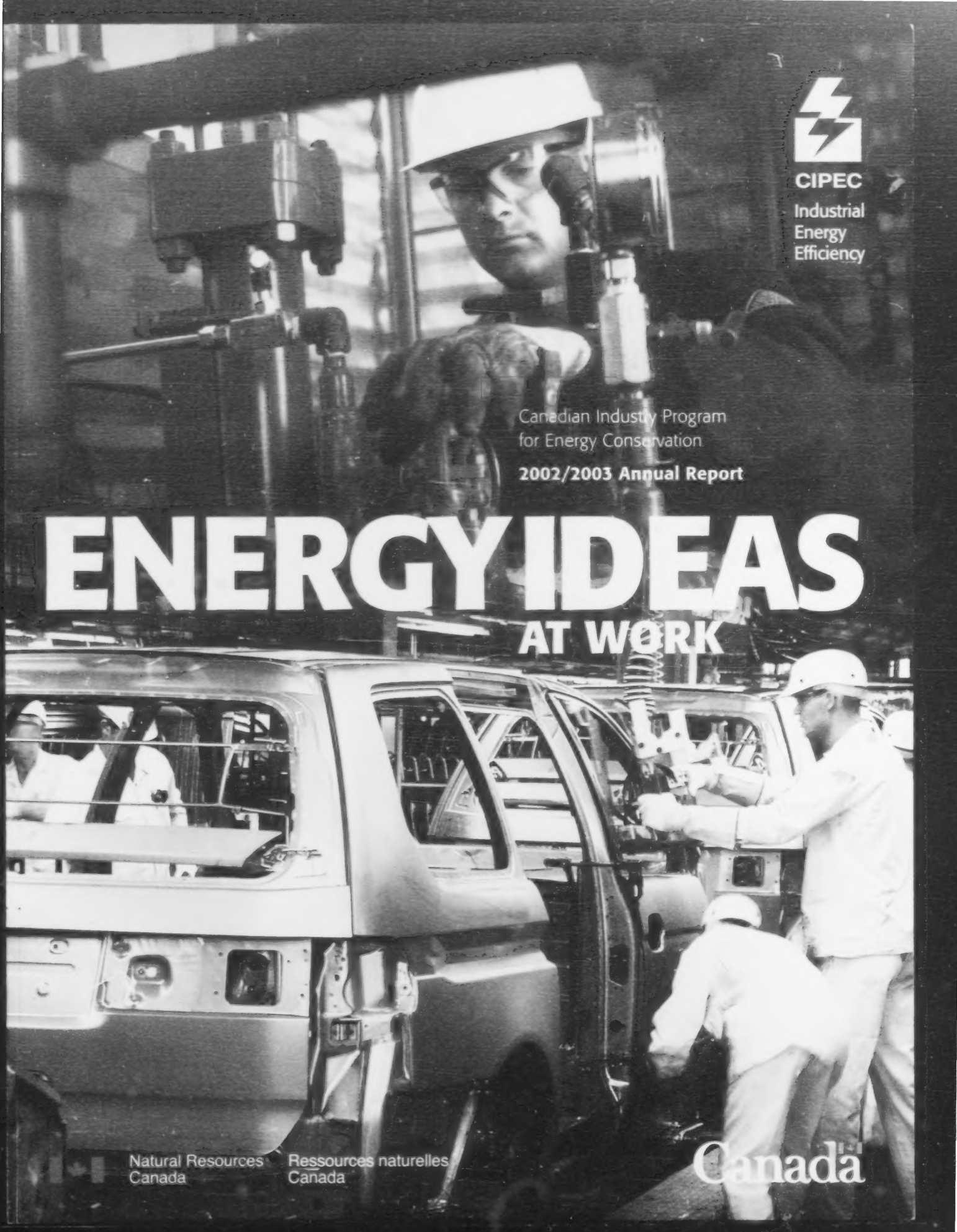

CIPEC
Industrial
Energy
Efficiency

Canadian Industry Program
for Energy Conservation

2002/2003 Annual Report

ENERGY IDEAS AT WORK

Natural Resources Canada
Ressources naturelles Canada

Canada

Library and Archives Canada Cataloguing in Publication

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For more information or to receive additional copies of this publication, contact

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2002/2003 ANNUAL REPORT

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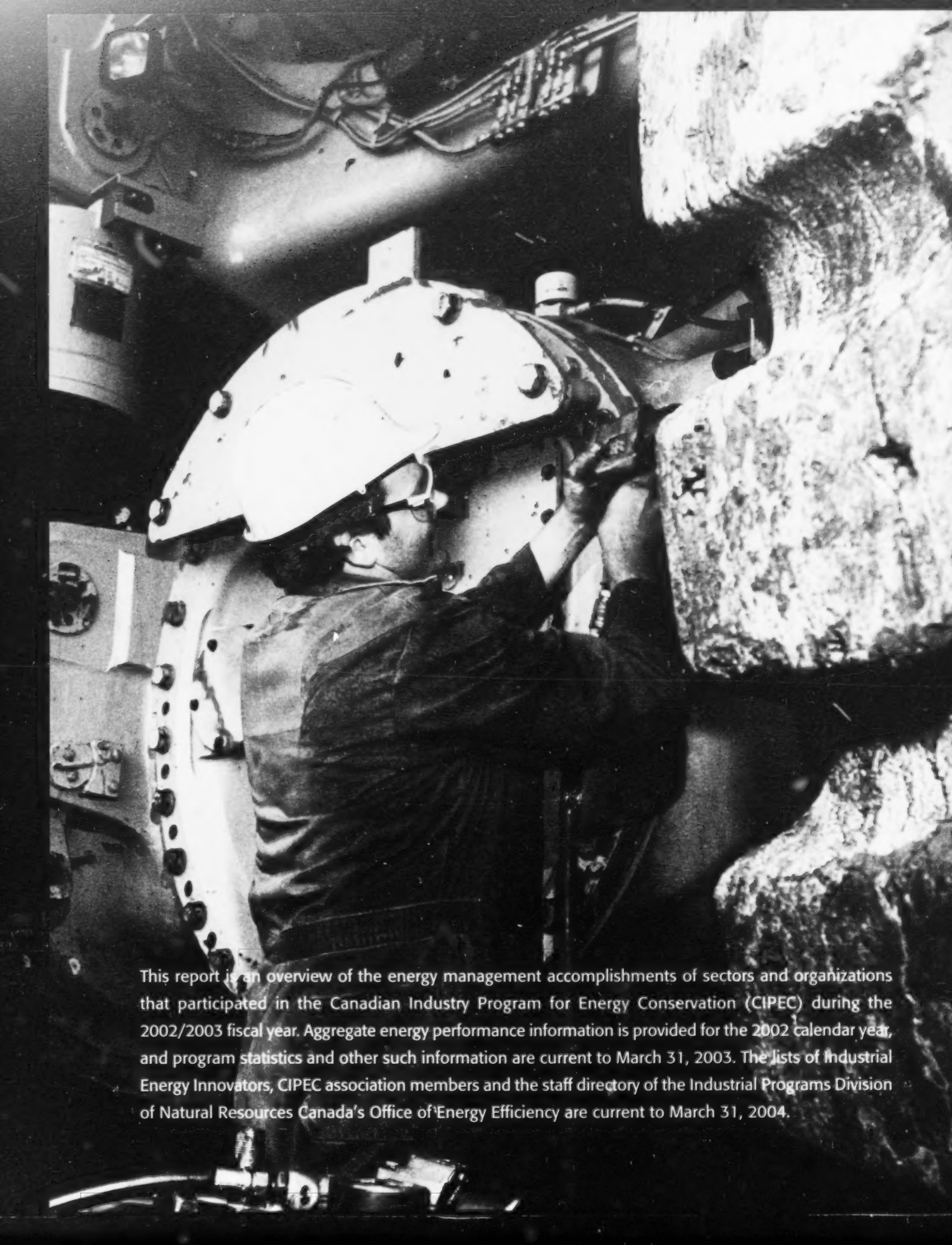
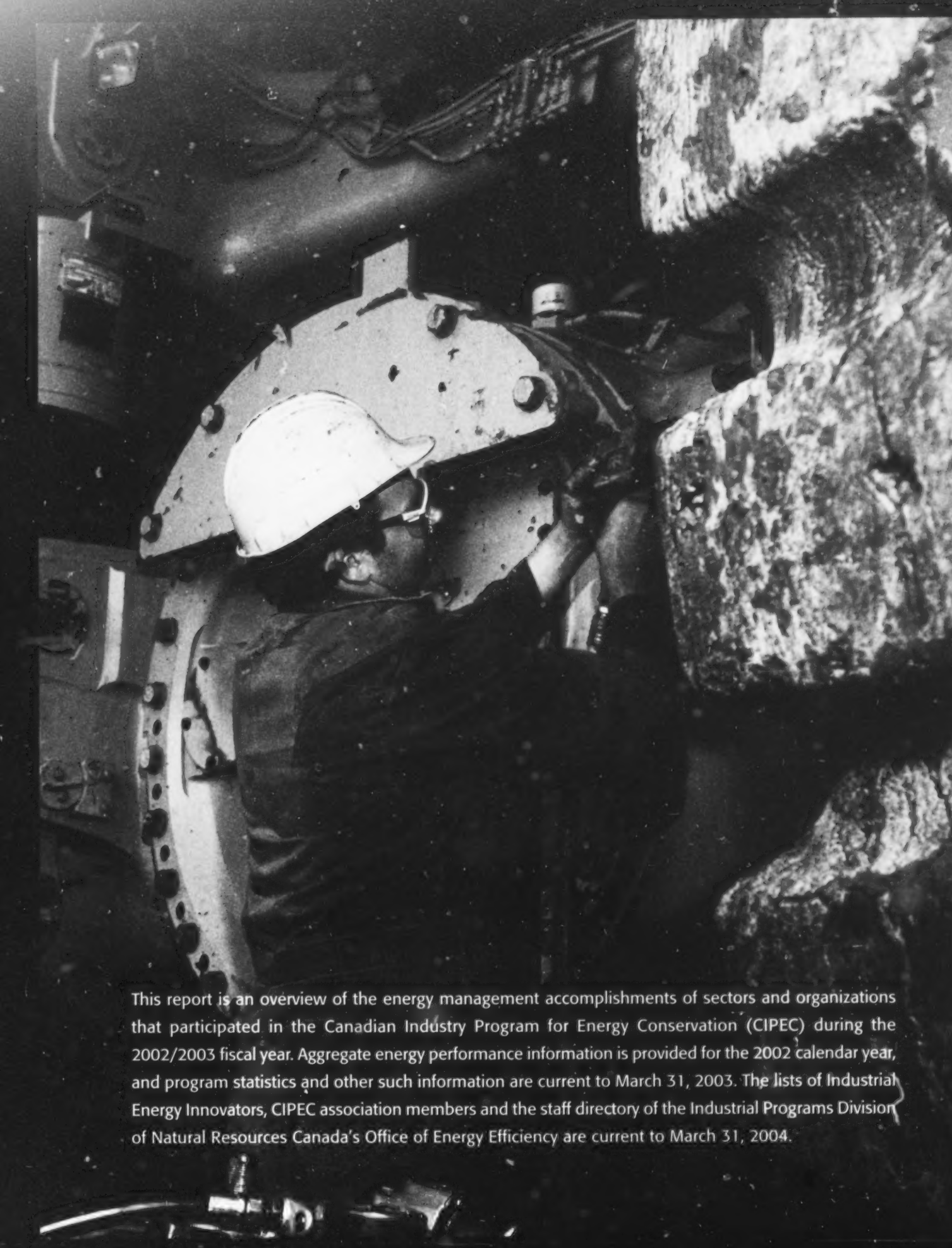
OUR MISSION

To promote effective voluntary action that reduces industrial energy use per unit of production, thereby improving economic performance while participating in meeting Canada's climate change objectives.

The success stories featured in "The Mark of Success" in this report exhibit the vision and perspective that symbolize CIPEC's mission.



This report is an overview of the energy management accomplishments of sectors and organizations that participated in the Canadian Industry Program for Energy Conservation (CIPEC) during the 2002/2003 fiscal year. Aggregate energy performance information is provided for the 2002 calendar year, and program statistics and other such information are current to March 31, 2003. The lists of Industrial Energy Innovators, CIPEC association members and the staff directory of the Industrial Programs Division of Natural Resources Canada's Office of Energy Efficiency are current to March 31, 2004.



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Message from the Chair

Consistency in TURBULENT TIMES

As the world continues to experience ever-accelerating change, Canadian industry is forced to cope with a myriad of complex, often conflicting, demands. Energy efficiency continues to be a key corporate objective for many businesses, but it must compete with other pressing business imperatives for limited financial resources. And while cutting greenhouse gas (GHG) emissions is now a critical necessity, changing customer preferences and competing regulatory requirements often make it difficult for industry to make progress.

When CIPEC was founded in 1975, Canada was in the midst of an energy crisis. Industry leaders and government came together to develop strategies to conserve scarce energy resources in a sensible, pragmatic and voluntary manner and to preserve industrial growth. In the 1980s, rising energy costs became the driver for energy conservation, and Canadians began to understand the relationship between energy use and environmental problems such as acid rain. Then, in the 1990s, a scientific consensus concluded that GHGs produced by fossil fuel production and consumption contribute substantially to climate change. Canada's ratification of the Kyoto Protocol in December 2002 committed the country to reduce GHG emissions by 6 percent below 1990 levels within the next decade. This report documents Canadian industry's progress in meeting energy intensity targets and outlines its contribution toward reducing GHG emissions.

Delivering Vital Tools

For almost three decades, CIPEC has provided a beacon of consistency through turbulent and radically changing times, providing industry with the tools it needs to find ways to manage energy effectively while remaining internationally competitive. As the pressure to reduce GHG emissions intensifies, these tools are an ever-more vital resource for industry as companies seek to reshape their practices to meet more demanding mandates.

The numbers confirm CIPEC's relevance. Over the past 29 years, the organization has built a network comprising 46 trade associations, representing more than 5000 industrial organizations. Highlights in 2002 included the following:

- CIPEC industries contributed almost $286 billion to the Canadian economy, representing about 29 percent of Canada's GDP.
- Industries represented by CIPEC directly employed almost 3.4 million people in Canada. This is over 20 percent of Canadian jobs.
- Thanks to effective energy management, Canadian industry avoided approximately $3.4 billion in purchased energy. This is equivalent to the energy needed to supply three out of every four homes in Ontario for a year.

Between 1990 and 2002, overall energy performance of CIPEC members was as follows:

- All CIPEC industries improved their combined energy intensity by 8.1 percent, or an average of 0.7 percent per year. Had energy intensity remained constant, GHG emissions would have been 25.2 megatonnes higher.
- Mining, manufacturing and construction member industries improved their energy intensity by an average of 1.9 percent per year. This was complemented by a 1.3 percent average annual improvement in energy efficiency. In 2000, these CIPEC sector members made a public voluntary commitment to achieve an average energy intensity improvement of 1 percent per year for the years 1990 to 2005.

Broad, Effective Coverage

The number of CIPEC task forces continues to grow. Including the preliminary steps taken in the past year to establish a plastics sector task force, there are now 26 task forces dedicated to helping a broad spectrum of industrial sectors establish and meet their energy efficiency targets. The program now includes energy producers and the manufacturing, mining and non-residential construction industries. These companies comprise approximately 95 percent of industrial energy use in Canada. In addition, the participation of small and medium-sized enterprises is growing. Through CIPEC, this network of mining, manufacturing, construction and energy-producing organizations has together avoided 25.2 megatonnes of GHG emissions between 1990 and 2002.

CIPEC continues to consider the establishment of new task forces, which enable companies in specific industrial sub-sectors to focus more directly on their individual energy management needs. In addition to establishing a plastics sector task force we are also laying the groundwork for a pipelines task force.

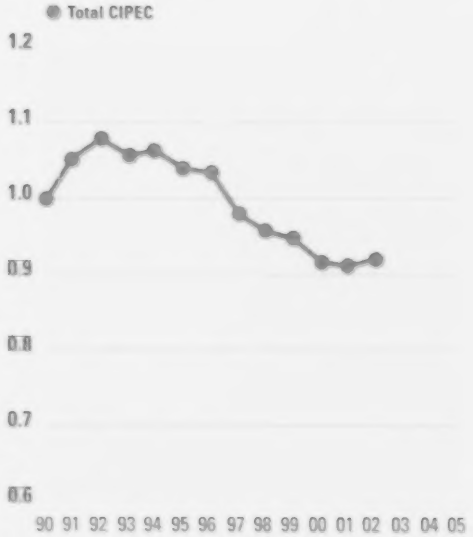
Our newly launched Energy Managers Network has made significant gains since its establishment. On March 26, 2003, over 200 industrial energy managers from across Canada participated in a one-day conference in Ottawa focusing on the strategic development of an energy management plan, the understanding and management of financial barriers to energy efficiency project implementation, and the need for effective communication when selling energy efficiency projects within an organization. The conference was an outstanding success, meeting or exceeding the expectations of the participants. There are now 100 members in the Energy Managers Network, with communication occurring through plant meetings as well as the Network's own Web site (oee.nrcan.gc.ca/cipec/ieep/emn).

Industrial Energy Innovators Roster Grows

Participation by Industrial Energy Innovators is also on the rise. As of March 31, 2004, new enrolment totalled 137 companies, or more than three times the number of companies earmarked in our recruitment target. Innovator companies now total 519. Regrettably, the filing of Industrial Energy Innovator reports is below target – only 75 compared with our target of 140. For a number of regulatory and business reasons, companies are increasingly reluctant to report publicly on their energy efficiency progress.

Total CIPEC Mining, Manufacturing, Construction and Energy Producers

Normalized Energy Intensity 1990 = 1.0



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Mining, Manufacturing and Construction Progress Against Voluntary Commitments

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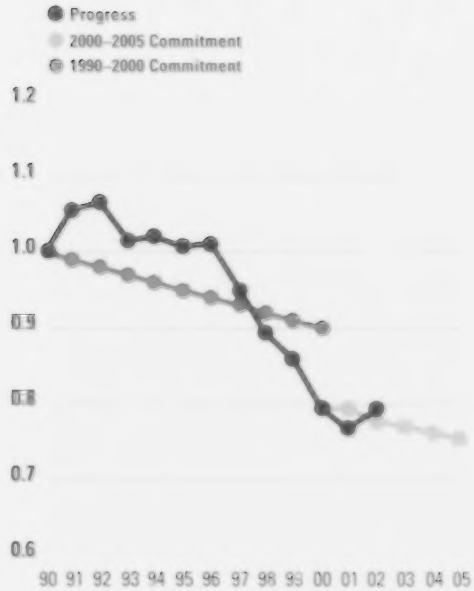


Mining, manufacturing and construction member industries improved their energy intensity by an average of 1.9 percent per year. This was complemented by a 1.3 percent average annual improvement in energy efficiency. In 2000, these CIPEC sector members made a public voluntary commitment to achieve an average energy intensity improvement of 1 percent per year for the years 1990 to 2005.

CIPEC Programs Yield Results

CIPEC is able to attract a growing number of companies, in large part because it opens the door to a powerful array of energy management tools. Increasingly, companies are using these tools to drive energy efficiency throughout their organizations. Here again, the numbers tell the story:

- Energy audits reached 100 percent of their target for the 2002/2003 fiscal year. Since the program was launched in 2001, Natural Resources Canada (NRCan) has funded 105 audits, covering an overall fuel bill of approximately $400 million.
- Benchmarking studies have been completed for a number of industries, including dairy, cement, mining, petroleum products, transportation equipment manufacturing, pulp and paper, and potash fertilizers. Benchmarking is currently underway for textiles, fisheries, wood products, upstream oil and gas, steel, grananes and mills, and nitrogenous fertilizers. Discussions are also on track concerning a benchmarking study for electricity generation.
- Dollars to $ense workshops attracted 440 participants in 2002/2003, or 110 percent of CIPEC's target for the year. Since these workshops were launched in 1997, more than 1000 industry participants have attended. In 2002/2003, NRCan conducted a study to determine the effectiveness of its Dollars to $ense workshops. The results affirmed the importance of energy management training as a tool for realizing energy efficiency and GHG emissions savings. Industrial participants are saving slightly more than 3 petajoules of energy per year, resulting in GHG reductions of 0.18 megatonne annually.

The Savings Are Real

CIPEC programs help companies look beyond the costs of achieving energy efficiency to discover the benefits. Examples include the following:

- Modern compressors and proper pipe and component maintenance at a typical manufacturing plant can reduce the energy used to produce compressed air by 5 to 25 percent.
- Strategic investments in steam plant design and maintenance can reduce the energy used for steam production by 5 to 15 percent.
- Modern lighting technologies and controls can provide superior lighting quality and save 10 to 30 percent in lighting costs.
- High-efficiency systems such as direct contact water heaters and improved insulation on piping and pressure vessels can save more than 20 percent of a plant's energy costs for water heating.

A Promising Future

Through effective energy management, Canadian industry is avoiding billions of dollars in fuel costs each year. While CIPEC has had a major role to play in that impressive achievement, the organization has only begun to scratch the surface. Energy efficiency still has immense potential to make positive economic and environmental contributions to industry and to Canadian society.

CIPEC's goal is to improve energy intensity in Canadian industry by a minimum of 1 percent per year. We will achieve this by understanding and overcoming the financial and other barriers that stand in the way. The opportunities are immense, and business and government must continue to work together to realize them. By joining forces to overcome obstacles today, CIPEC sectors will help to make energy efficiency as much a core business value for Canadian industry as operational excellence, financial performance, environmental leadership and technological innovation.

By thinking "beyond the box" to develop innovative, practical approaches, Canadian industry can lead the world in energy efficiency and the control of GHG emissions. Energy efficiency is good for business, good for our economy and vital for our environment. It also has a proven track record of helping Canadian industry save money, stay competitive and improve the bottom line. Nobody does more to help Canadian business achieve energy efficiency than CIPEC.

On behalf of the CIPEC network of industries, I would like to thank NRCan for its ongoing support of CIPEC's unique public and private sector partnership. The challenges ahead are formidable, but with imagination, commitment and joint effort, I am certain that we can overcome whatever obstacles stand in our way.

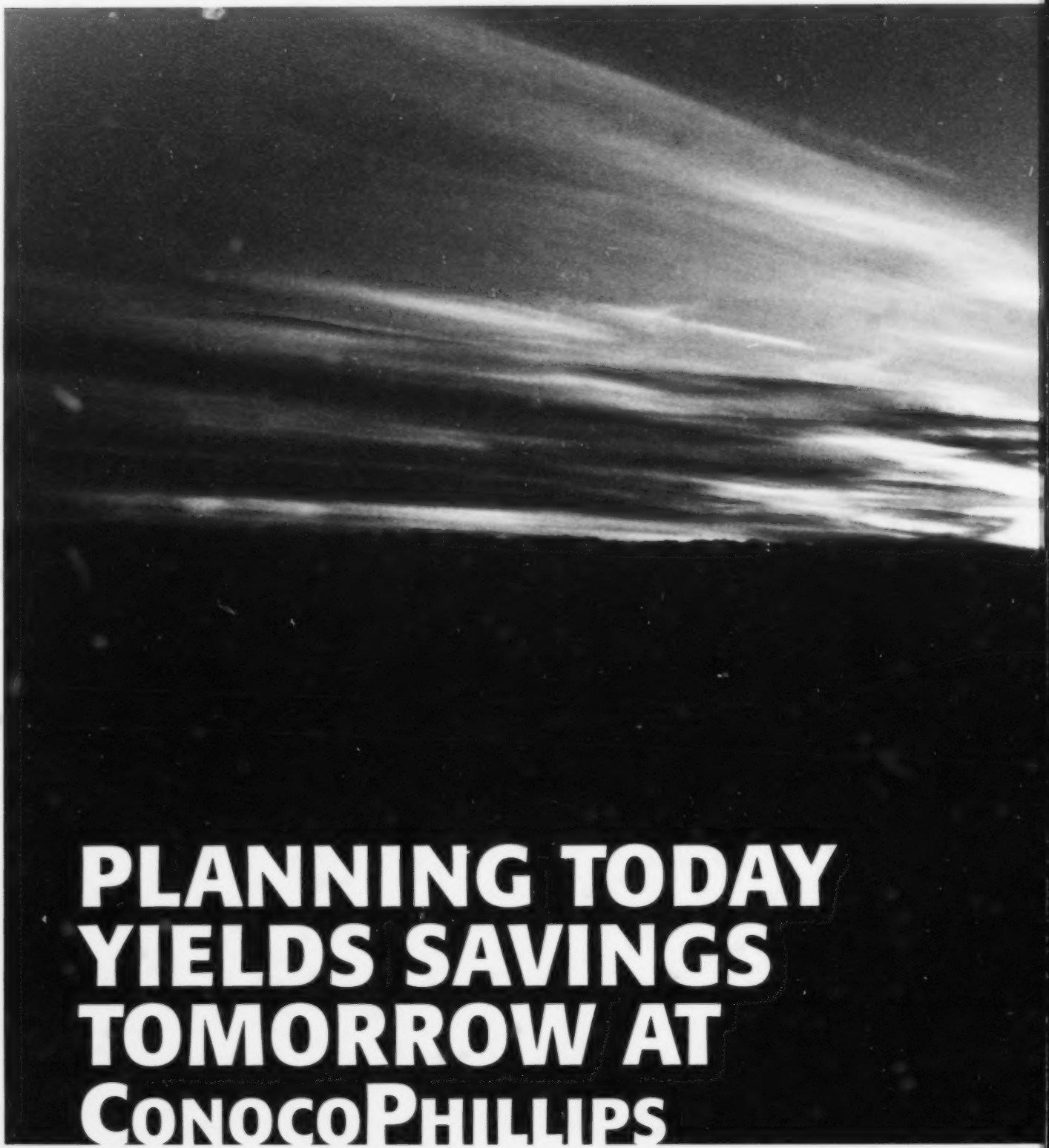
Douglas E. Speers
President and CEO, EMCO Corporation
Chair, CIPEC Executive Board

THE MARK OF SUCCESS

The 12 industrial companies featured in the following pages are setting new standards in their drive to improve energy efficiency. Whether it's identifying unique or creative processes through investments in new technology, improving operating practices, implementing effective employee awareness campaigns or raising the profile of energy conservation within corporate boardrooms, these companies demonstrate what is possible when it comes to improving energy efficiency in Canada's industrial sector.

Each of the stories featured here – selected from over 500 CIPEC Industrial Energy Innovator companies – summarizes a better approach to managing the use of energy, thereby reducing greenhouse gas (GHG) emissions that contribute to climate change and helping Canada meet its Kyoto Protocol commitments. In doing so, they prove that, in the face of escalating energy costs, what is good for the environment is also good for the bottom line.

These stories are a sampling from the hundreds of firms in every industrial sector across Canada that are committed to responsible energy use. Their success is a testament to industry's ability to act on energy management opportunities and take a leadership role in Canada's energy performance and climate change goals.

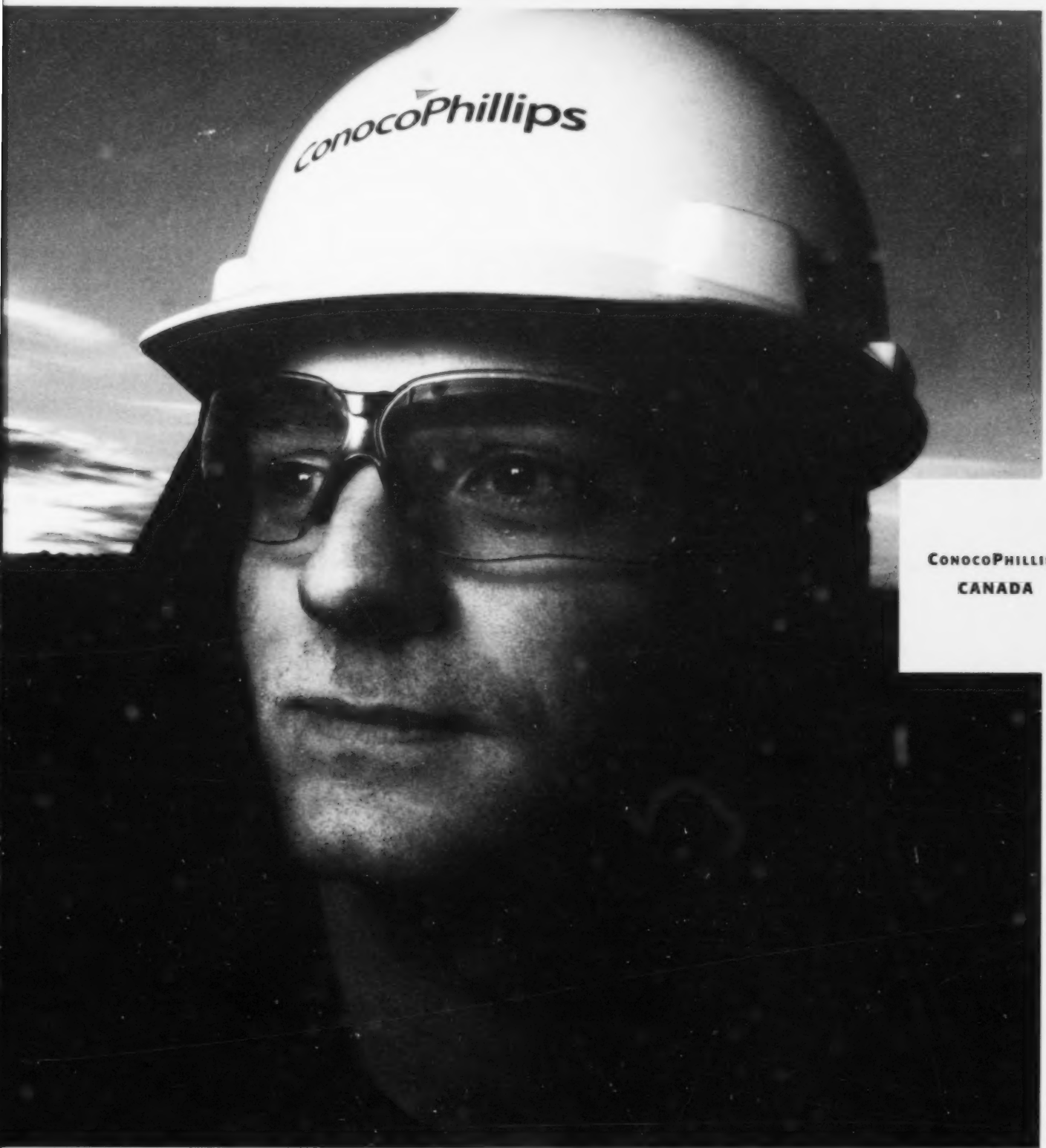


PLANNING TODAY YIELDS SAVINGS TOMORROW AT CONOCOPHILLIPS

ConocoPhillips Canada is implementing a plan to reduce its energy use in the exploration and production of oil and natural gas from its western Canadian operations. Based in Calgary, Alberta, the company is integrating sustainable development factors into life-cycle decision making for its planning and operations. These factors include energy efficiency and GHG emissions reductions throughout its operations.

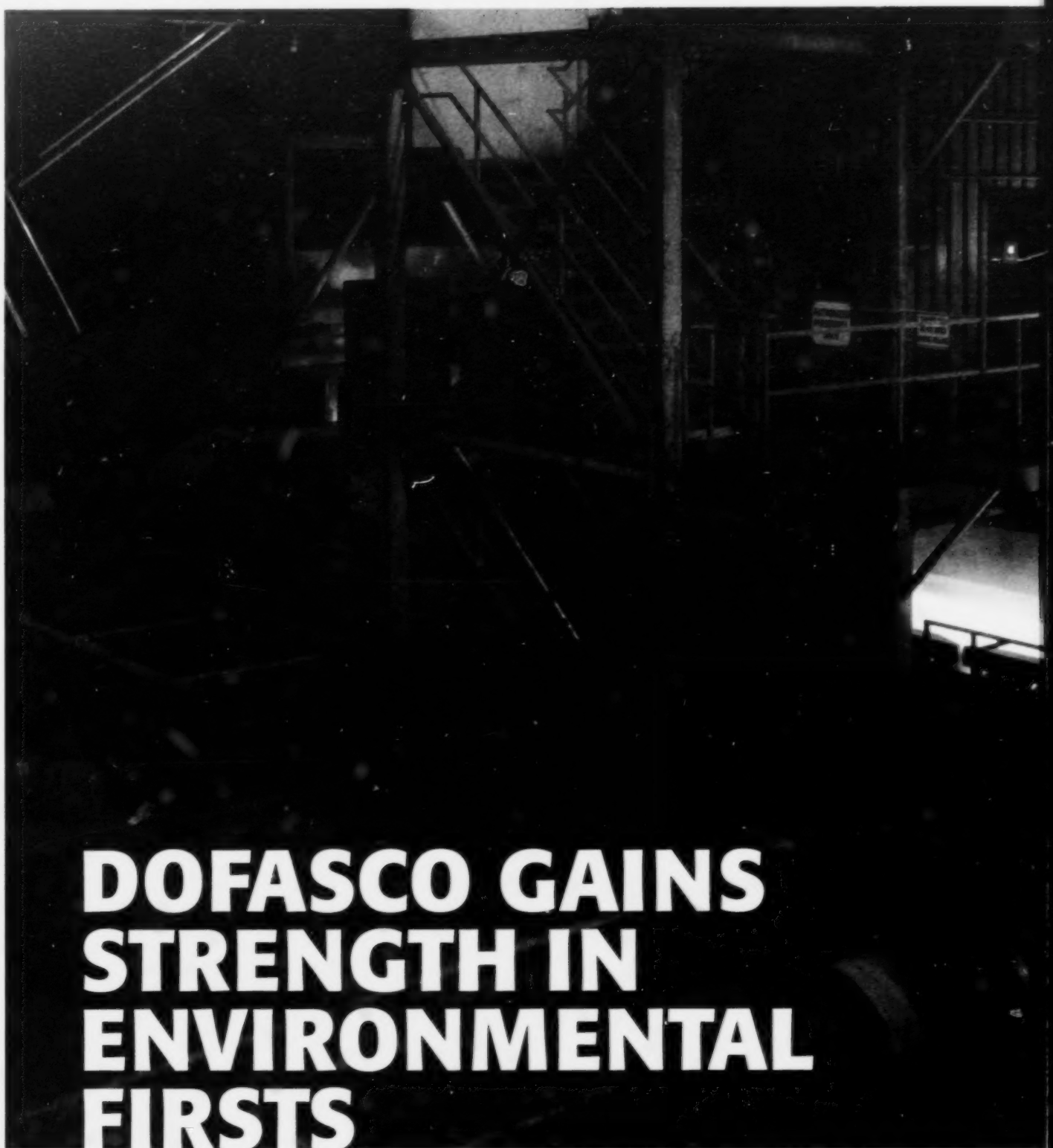
As part of the company's GHG strategic management plan, the current on-line flare tracking system for operators and engineers is being expanded to include energy efficiency and emissions-reduction projects. Energy efficiency programs include identifying better operating practices and investing in new equipment.

For example, a company-wide solution gas flaring- and venting-reduction program introduced several years ago has proved



ConocoPhillips
CANADA

successful in reducing emissions each year. In 2002, ConocoPhillips Canada achieved a 24 percent and 29 percent reduction in flaring and venting, respectively, below 2001 levels, exceeding its annual target of 15 percent. In addition, ConocoPhillips Canada reported a 4 percent reduction in CO_2-equivalent (CO_2e) emissions intensity (production carbon intensity) for 2002 compared with 1990 baseline levels, and it achieved an overall reduction of 237 kilotonnes of CO_2e, or 7.3 percent, from 2001 to 2002. To help develop the culture to reduce emissions and emphasize the importance of GHG emissions reductions, ConocoPhillips Canada conducts employee and public education initiatives. All ConocoPhillips Canada employees are being encouraged through several ongoing initiatives to be individually energy efficient and reduce GHG emissions at home and at work.



DOFASCO GAINS STRENGTH IN ENVIRONMENTAL FIRSTS

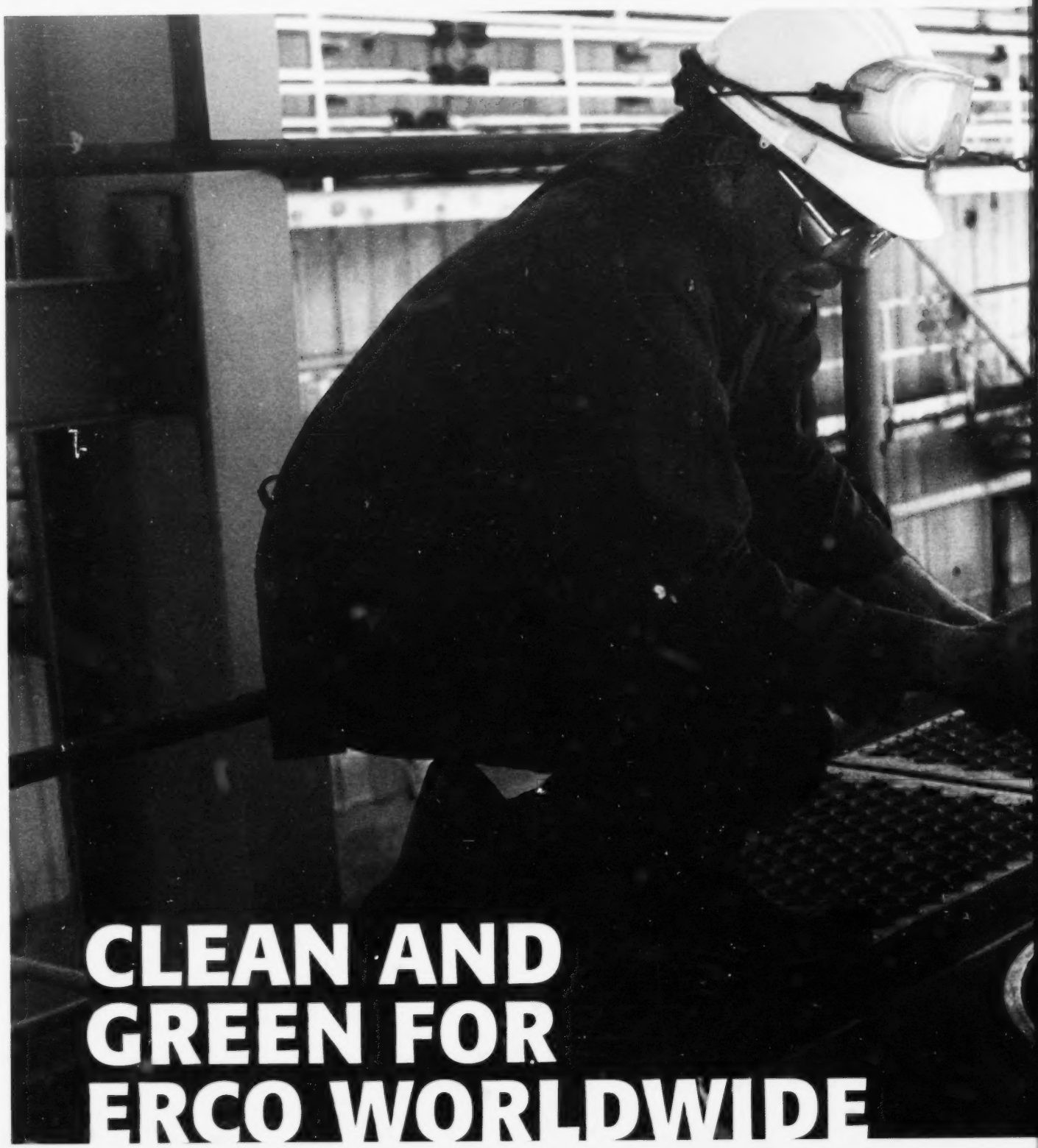
Canadian steelmaker Dofasco Inc. is so serious about environmental responsibility that it has made this aspect of its operations – along with financial performance and social well-being – one of three critical measures of its business success. Dofasco takes an integrated approach to sustainability, managing resources to save energy and reduce waste, embracing innovation to prevent pollution, and working with suppliers and customers to improve the environmental performance of its products throughout their life cycle.

In 1997, Dofasco became the first private organization in Canada to sign an Environmental Management Agreement with the Government of Canada and the Government of Ontario. This seven-year agreement exceeds all established regulatory requirements.

DOFASCO INC.

The company is the only steel company listed in the Dow Jones Sustainability World Index and the only Canadian company to be named a Market Sector Leader.

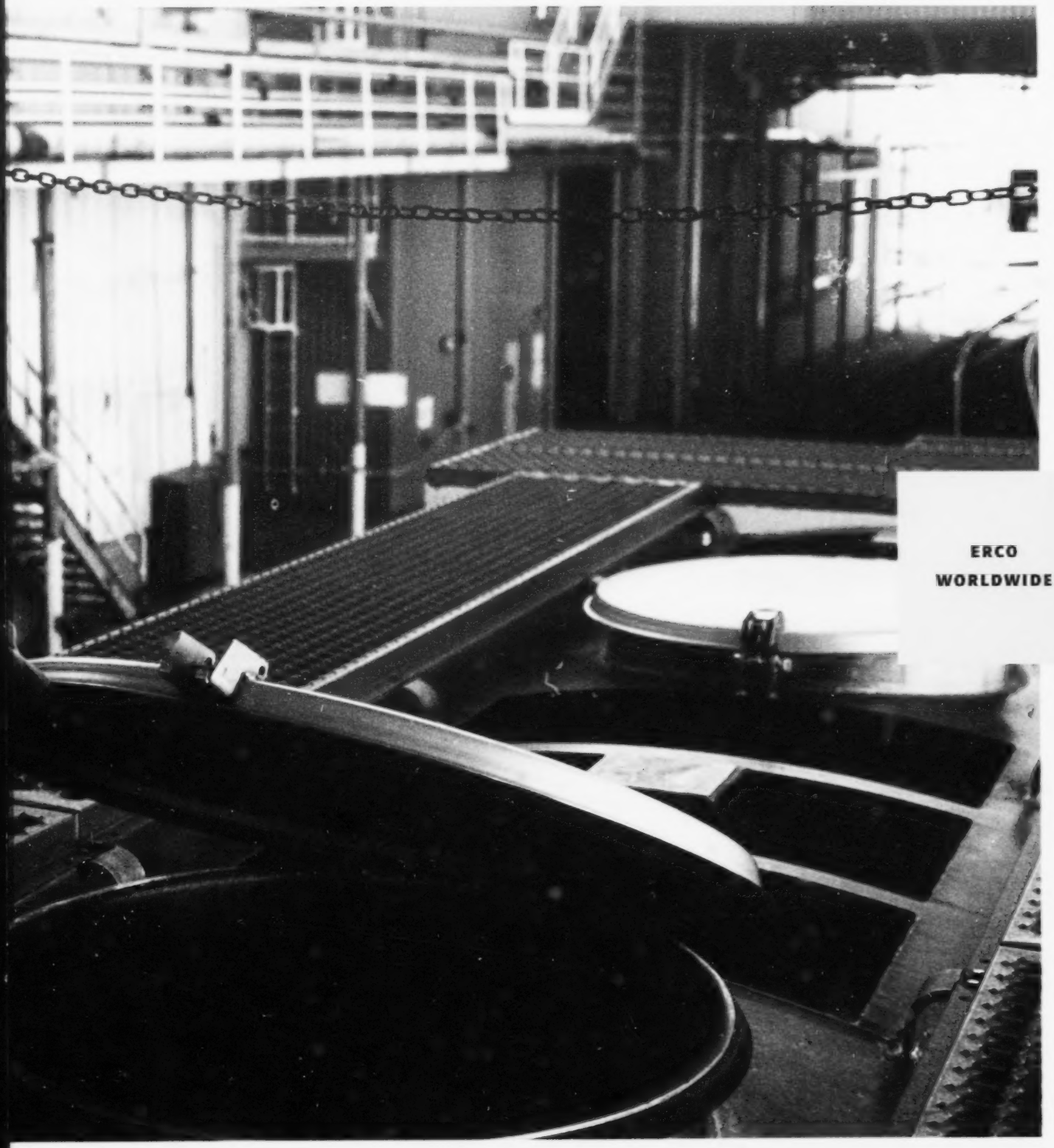
Between 1990 and 2001, Dofasco reduced its specific energy consumption by 1.86 percent per year, its total annual GHG emissions by 18.3 percent and its direct emissions by a remarkable 24 percent. The company plans to build on its success by reducing its specific energy consumption by an additional 1 percent per year through 2010.



CLEAN AND GREEN FOR ERCO WORLDWIDE

ERCO Worldwide prides itself on demonstrating its belief in sustainable manufacturing by making the investments needed to get results. Embracing cutting-edge and environmentally clean technologies has led this chemical company, based in Toronto, Ontario, to the forefront of its industry.

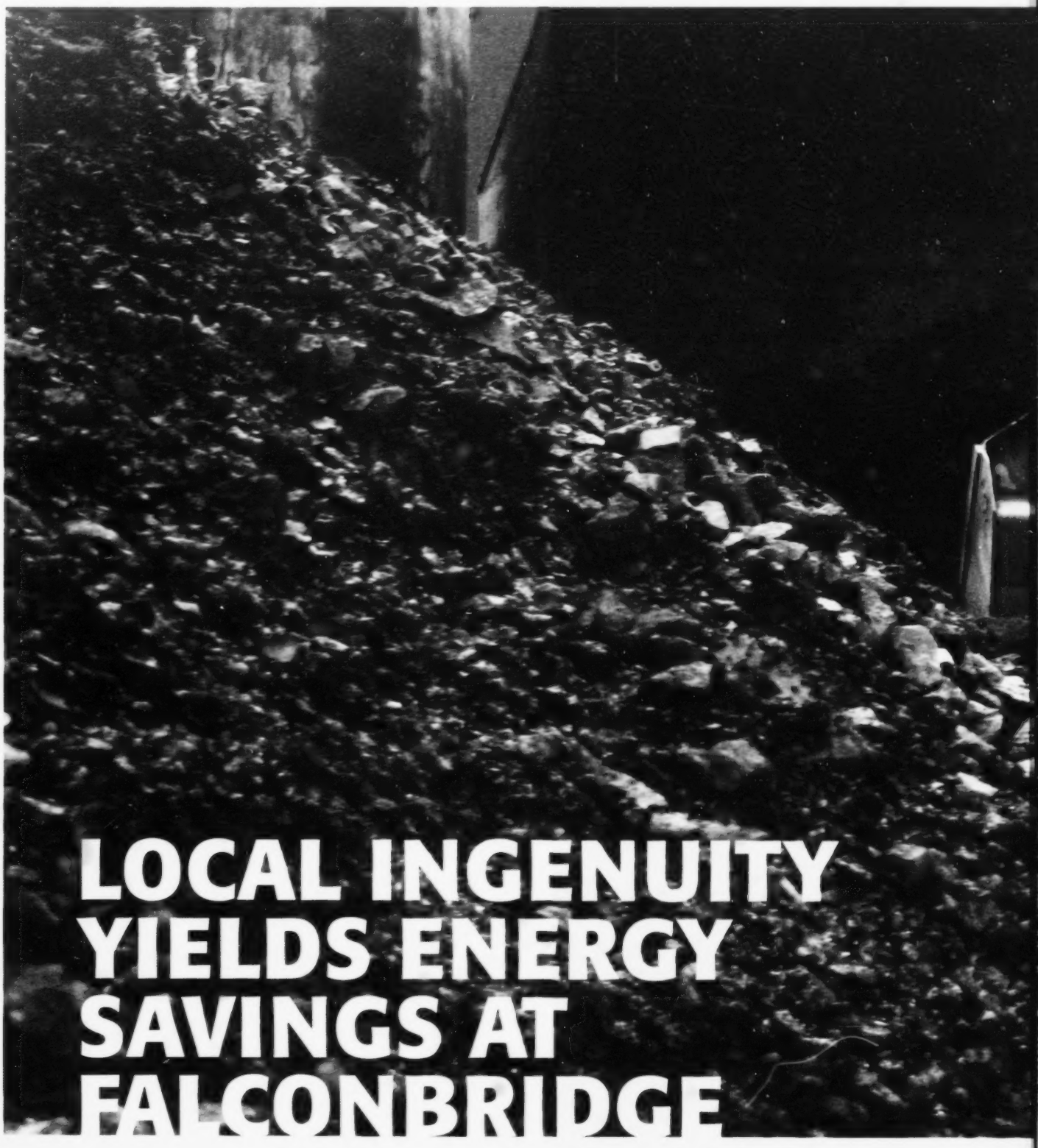
One of its latest and most innovative projects has enabled the company to use waste gas to slash its fossil fuel consumption and GHG emissions. In 1995, ERCO launched a pilot project at its plant in Buckingham, Quebec, to convert waste hydrogen – a by-product of the electrolytic process – into fuel for the facility's steam plant. Investing $1.1 million in new technology, the company



ERCO WORLDWIDE

has displaced about 6.5 million litres of fossil fuel consumption and realized energy cost savings of more than $2.25 million per year since the system became fully operational in 2001.

More than satisfied with the results, the company applied the same approach at its plant in Saskatoon, Saskatchewan. Completed in early 2003 at a cost of $1.5 million, the installation has reduced the plant's use of fossil fuels by 33 percent and is saving $1 million annually in energy costs. Equally important, ERCO has reduced its GHG emissions by 30 percent. And by eliminating hundreds of oil deliveries each year at the plants, local streets are quieter, residents are happier, and the air is a lot easier to breathe.



LOCAL INGENUITY YIELDS ENERGY SAVINGS AT FALCONBRIDGE

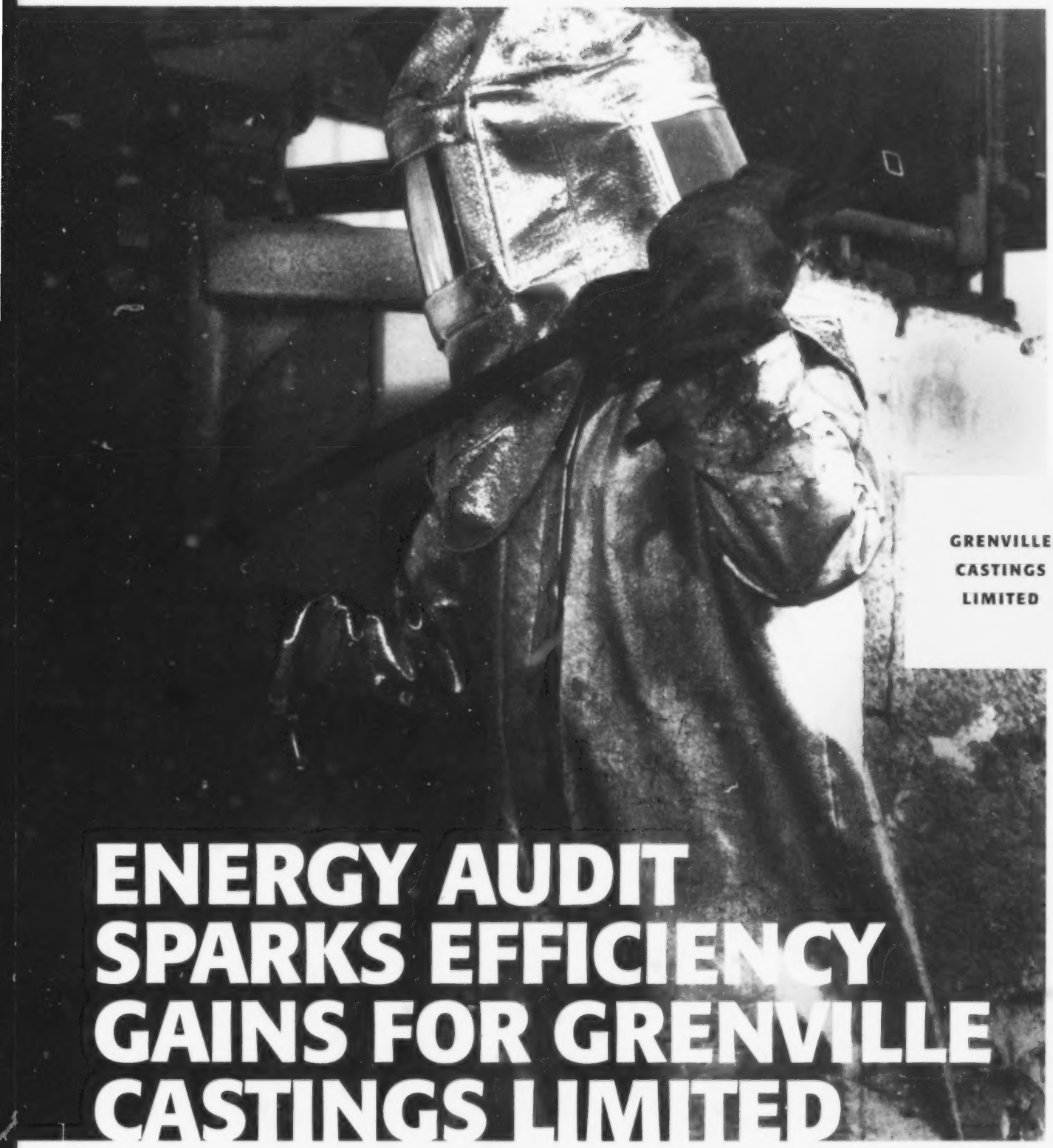
Innovative thinking about energy by employees at Falconbridge Limited's mines in Sudbury, Ontario, has enabled the company to gain greater control over its electricity consumption. Staff has developed spreadsheet-based tools to make electricity usage visible in real time. Using a unique, easy-to-understand graphical interface, control-room operators keep power consumption at preset target levels by controlling power loads, shifting non-time-sensitive activities (such as water pumping, material hoisting and crushing) from periods when electricity costs are high to off-peak hours, when power rates are lower. Staff reviews the system's daily consumption report to analyse energy patterns and find ways to reduce consumption. On a number of occasions, this analysis has enabled staff

FALCONBRIDGE LIMITED

to isolate and correct energy-wasting malfunctions, such as underground compressed-air leaks, which might otherwise remain undetected for weeks.

The system is also a powerful strategic planning tool that analyses the electricity market and helps management plan its activities to minimize energy costs. Information provided by the system has enabled the company to adjust its operations, including work schedules, to shift demand to hours when electricity prices are lower. By making energy patterns visible to staff at all levels, Falconbridge has sparked new interest in energy efficiency at its mines and has opened opportunities to gain greater control over its costs.

The first step to getting to any destination is to know where you are. That's what prompted Grenville Castings Limited to launch an energy audit by the Canadian Foundry Association of its facilities in Merrickville, Smiths Falls and Perth, all in Ontario. The audit provided the aluminum casting company's energy team with consumption baselines, including quantification energy-use patterns for major processes and equipment. It also identified areas where significant savings could be realized, often with little or no capital investment.



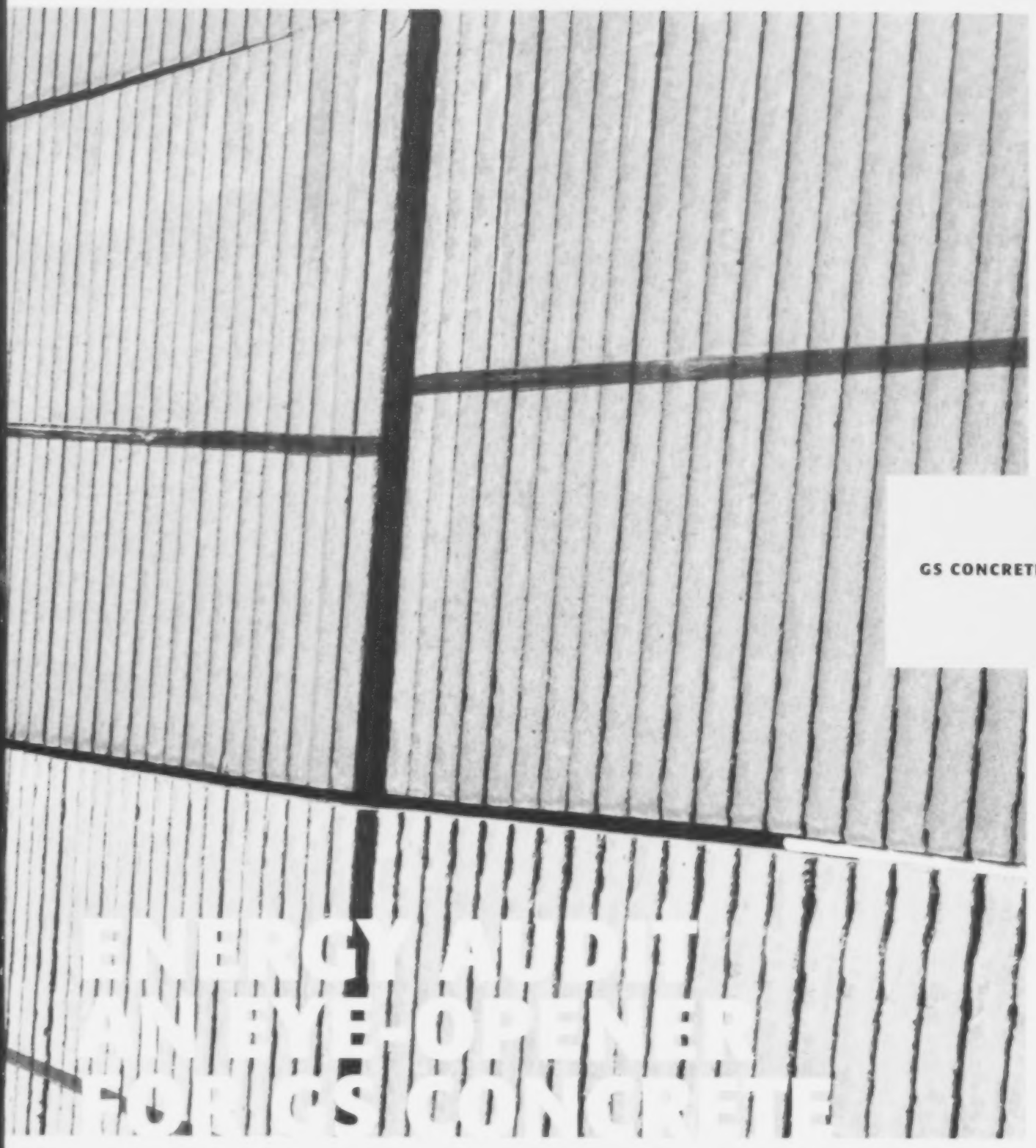
GRENVILLE CASTINGS LIMITED

ENERGY AUDIT SPARKS EFFICIENCY GAINS FOR GRENVILLE CASTINGS LIMITED

The energy audit focused on all aspects of energy use throughout the company, and the results have led Grenville to take action in all of its operations. Current initiatives are focused on scrap reduction, equipment optimization, power factor adjustment, operating schedules and preheating ventilation make-up air. These will not only help offset the increased costs of energy, but will reduce consumption and support Grenville's ISO 14001 objectives of energy reduction and pollution prevention.

GS Concrete was one of the first companies in the Maritimes to participate in NRCan's Industrial Energy Audit Incentive. Conducted at the company's precast concrete facility in Windsor, Nova Scotia, in spring 2002, the audit focused on the plant's energy costs, identified needed improvements and enabled management to set its energy efficiency investment priorities.

With the audit providing an accurate blueprint, the company initiated a series of practical steps that would yield results yet remain within the plant's capital investment budget. GS Concrete launched programs to retrofit overhead lighting, improve motor maintenance and upgrade plant wiring. A fire at the plant led to the removal of an aging steam curing boiler and the installation of a high-efficiency replacement.



GS CONCRETE

The audit motivated management and staff to look at a host of energy-related possibilities. For example, the company is evaluating the design of its electrical systems with an eye toward improving efficiency, and an electrician has been retained to conduct monthly inspections and replacements of aging and inefficient plant wiring. Manual overhead doors that were frequently left open in one section of the plant will be replaced with more easily closed motorized doors. The company will also soon begin thermographic testing of its electrical equipment to measure performance and pinpoint inefficiencies.

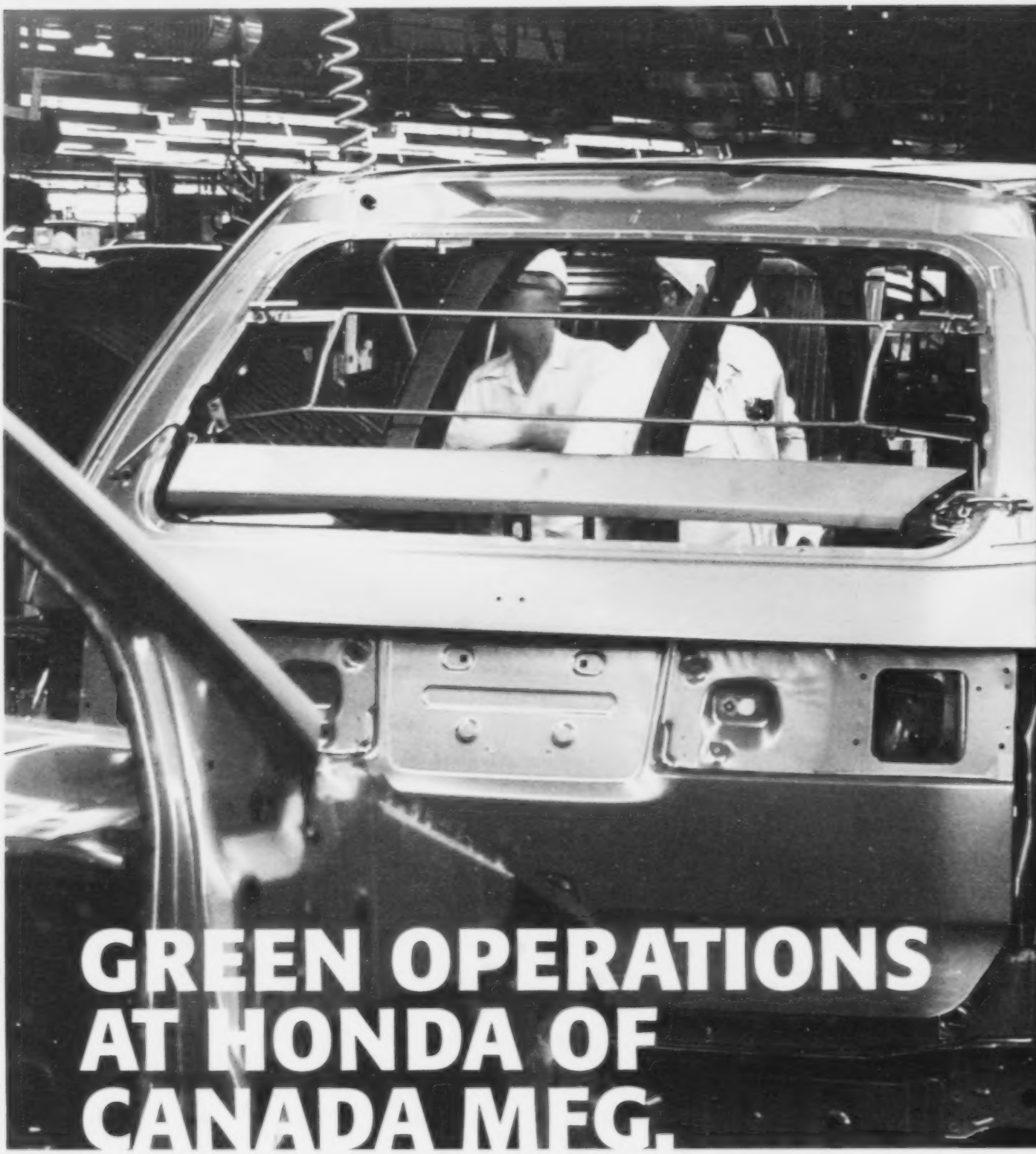


Photo courtesy of Honda of Canada Mfg.

GREEN OPERATIONS AT HONDA OF CANADA MFG.

Energy efficiency is a major component of Honda of Canada Mfg's efforts to "green" its manufacturing operations. The company set a goal of reducing energy consumption and associated GHG emissions per vehicle produced by 5 percent between 2000 and 2005. The Canadian automaker has already cut its GHG emissions by 7.6 percent per unit produced, and it plans to better that performance by the end of the year.

An ISO 14001 registered company, Honda of Canada Mfg. has incorporated GHG emissions reduction into all aspects of its operations. At its automotive plants in Alliston, Ontario, employees are encouraged to participate in a reforestation project on company property and along an adjacent stream bank. They are also rewarded for initiating ideas to improve energy efficiency. The

HONDA OF CANADA MFG.

company has recently invested in energy efficiency programs to retrofit lighting, optimize air-compressor capacity, upgrade paint robots, switch to more efficient energy sources and optimize equipment operating times and temperatures.

In its 2002/2003 fiscal year, Honda of Canada Mfg. completed conservation projects that represent energy savings of 1.3 percent per vehicle, even though unfavourable weather actually increased heating and cooling loads. From 1990 to 2002, it cut emissions generated per vehicle produced by a whopping 35 percent while more than tripling production. The company projects that by 2005 its energy efficiency activities will register an annual emissions reduction of 7000 tonnes of CO_2 equivalent compared with a 1990 business-as-usual scenario.

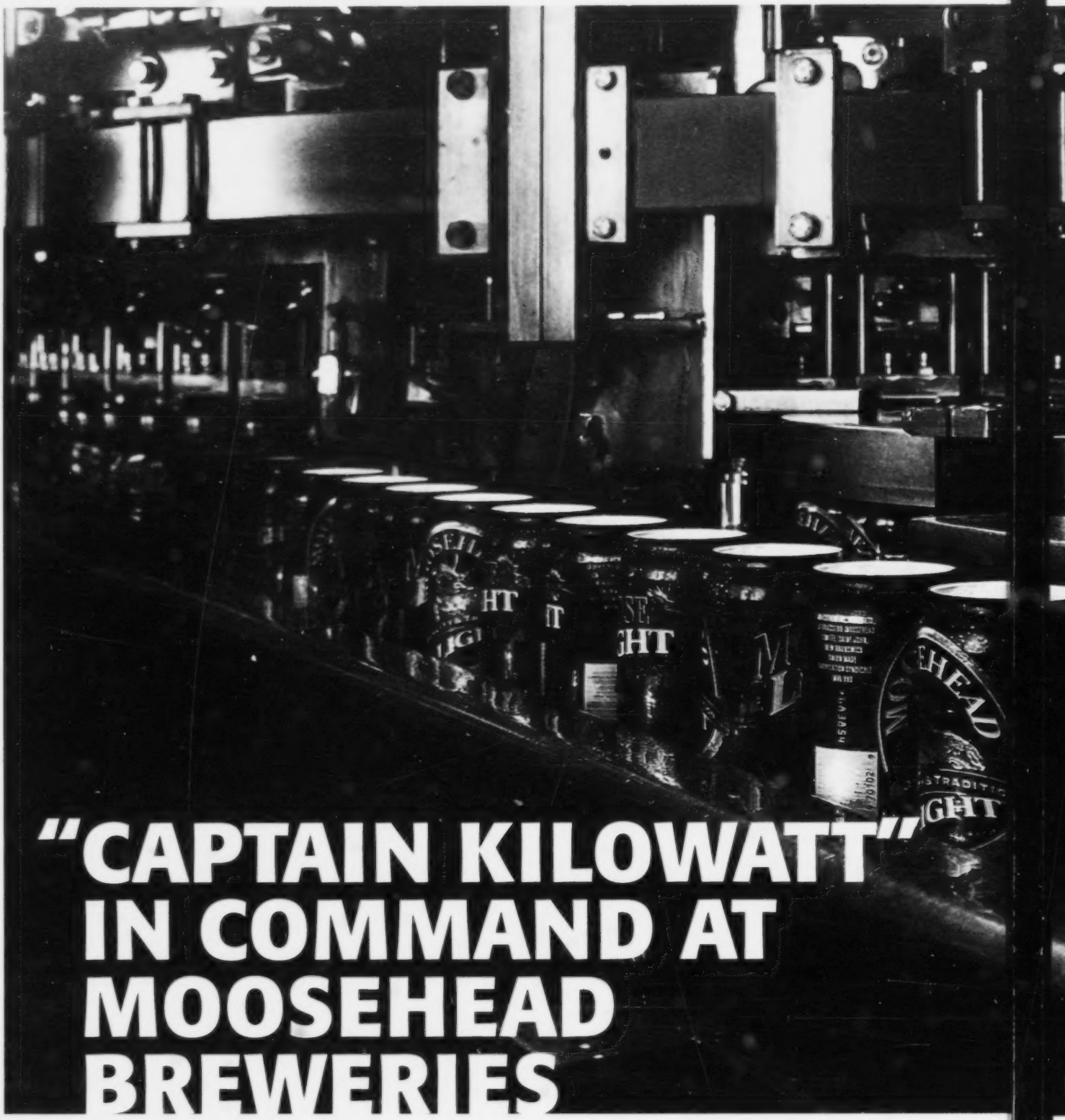


Photo courtesy of Moosehead Breweries Ltd.

"CAPTAIN KILOWATT" IN COMMAND AT MOOSEHEAD BREWERIES

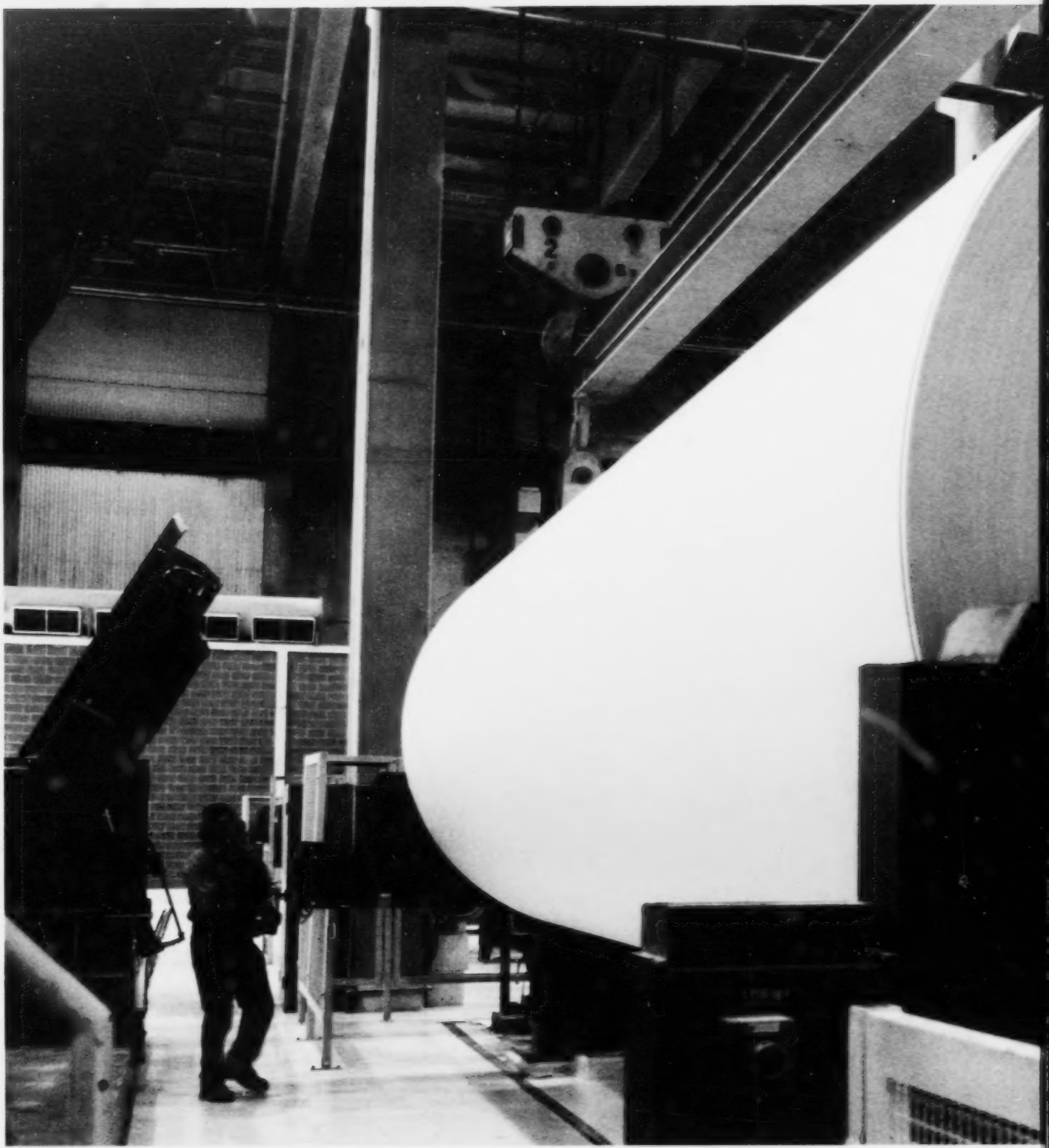
Moosehead Breweries Ltd. has complemented its already extensive energy efficiency program with an awareness initiative that reaches to the shop floor and beyond. "Captain Kilowatt" keeps employees at this brewery, based in Saint John, New Brunswick, informed of the cost of wasted energy due to air leaks, lights needlessly left on and unused equipment left running, and encourages staff to participate in energy conservation. The program has led to a lighting upgrade for energy efficiency throughout the facility and a reduction or shutdown of building systems when areas are unoccupied.

Encouraged by the success of Captain Kilowatt, Moosehead began to focus awareness efforts on key individuals and departments that have the most impact on energy consumption. As a result, security staff members now look for and correct energy waste as

MOOSEHEAD BREWERIES LTD.

they make their rounds. In the bottle shop, shift engineers ensure that unused areas of the plant are isolated during off hours and that services such as compressed-air, steam and CO_2 system operations are reduced or shut down. Supervisors and crew leaders help out by making sure that lighting and equipment are shut down when they are not needed.

By adding employee participation to its already impressive energy management program, Moosehead has sharpened its focus even more with its targeted energy efficiency initiatives.



Stora Enso North America's pulp and paper mill in Port Hawkesbury, Nova Scotia, is a testament to what can be achieved when opportunity embraces innovation. Since 2000, this mill's management has taken advantage of the availability of new fuel sources and invested heavily in new technology to make the mill increasingly energy efficient.

When natural gas from Sable Island became available in 2001, Stora Enso was one of the first east coast manufacturers to begin integrating the environmentally advantageous fuel into its operations. The switch to natural gas has reduced heavy oil use by more than 125 litres per tonne of product. When fuel switching is complete, this will lead to a total decrease in CO_2-equivalent (CO_2e) emissions of 58 522 tonnes per year by 2005, compared with a 1990 base year.

STORA ENSO NORTH AMERICA

OPPORTUNITY EMBRACES INNOVATION AT STORA ENSO

Stora Enso's Port Hawkesbury mill continues to invest in energy efficiency improvements, including consolidating operations to reduce occupied building space, launching a power reduction program and installing equipment such as process heat exchangers, steam accumulators and energy-efficient motors. The mill's most ambitious recent investment is the construction of a $90 million thermo-mechanical pulp line – its third – that will replace its aging groundwood and high-yield sulfite lines. Slated for start-up in fall 2004, the thermo-mechanical pulp line will reduce net emissions by nearly 34 kg of CO_2e per tonne of production.

Compared with 1990, the company expects to achieve an impressive 37.2 percent reduction in total direct fossil fuel GHG emissions and a 63.4 percent decrease in specific emissions per tonne of production by 2005.

Unilever Canada's margarine plant in Rexdale, Ontario, has been reducing its production costs through a wide array of energy-conservation initiatives since 1999.

The plant's energy team, the Watt Watchers, is making energy conservation second nature to the plant's 175 personnel. "Energy boards" posted throughout the plant are one way that employees – from office workers to engineers – can monitor the results of their energy-saving suggestions and take part in friendly competition to boost the number of ideas from employees. All suggestions are captured in an "opportunities database" and prioritized so that there is a continuous flow of ideas to implement.

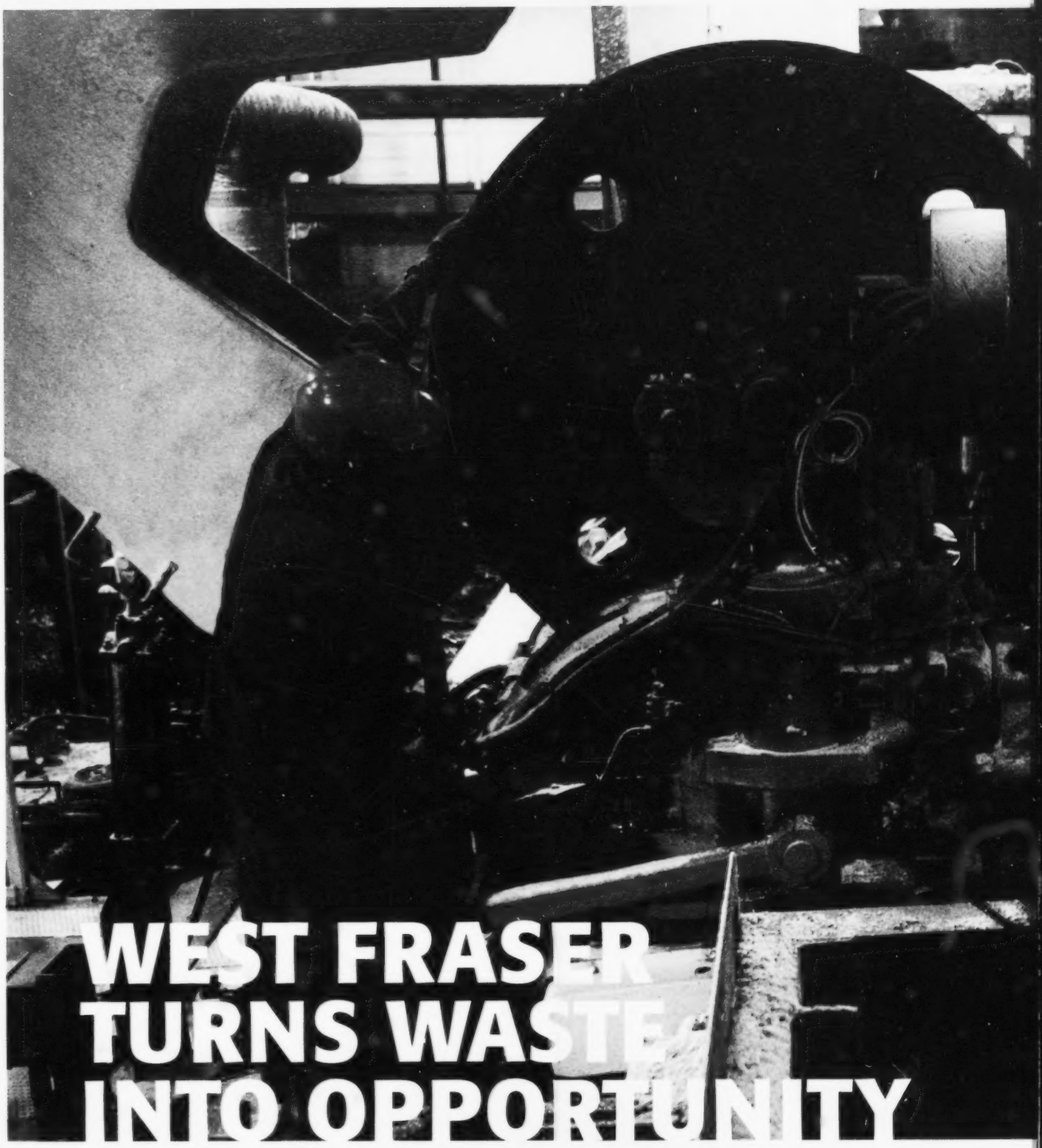
UNILEVER CANADA

UNILEVER REXDALE LEADING THE PACK IN ENERGY EFFICIENCY

Other initiatives have been to sub-meter the plant's energy use, post consumption trends and acquire Montage™ software to facilitate energy consumption management. The plant also held a Plant Energy Day in September 2003.

These and other actions have dramatically reduced the plant's energy use. Unilever Rexdale's cumulative savings since 1999 are expected to surpass $3 million in 2004, with an average payback period of six months for each of its conservation projects.

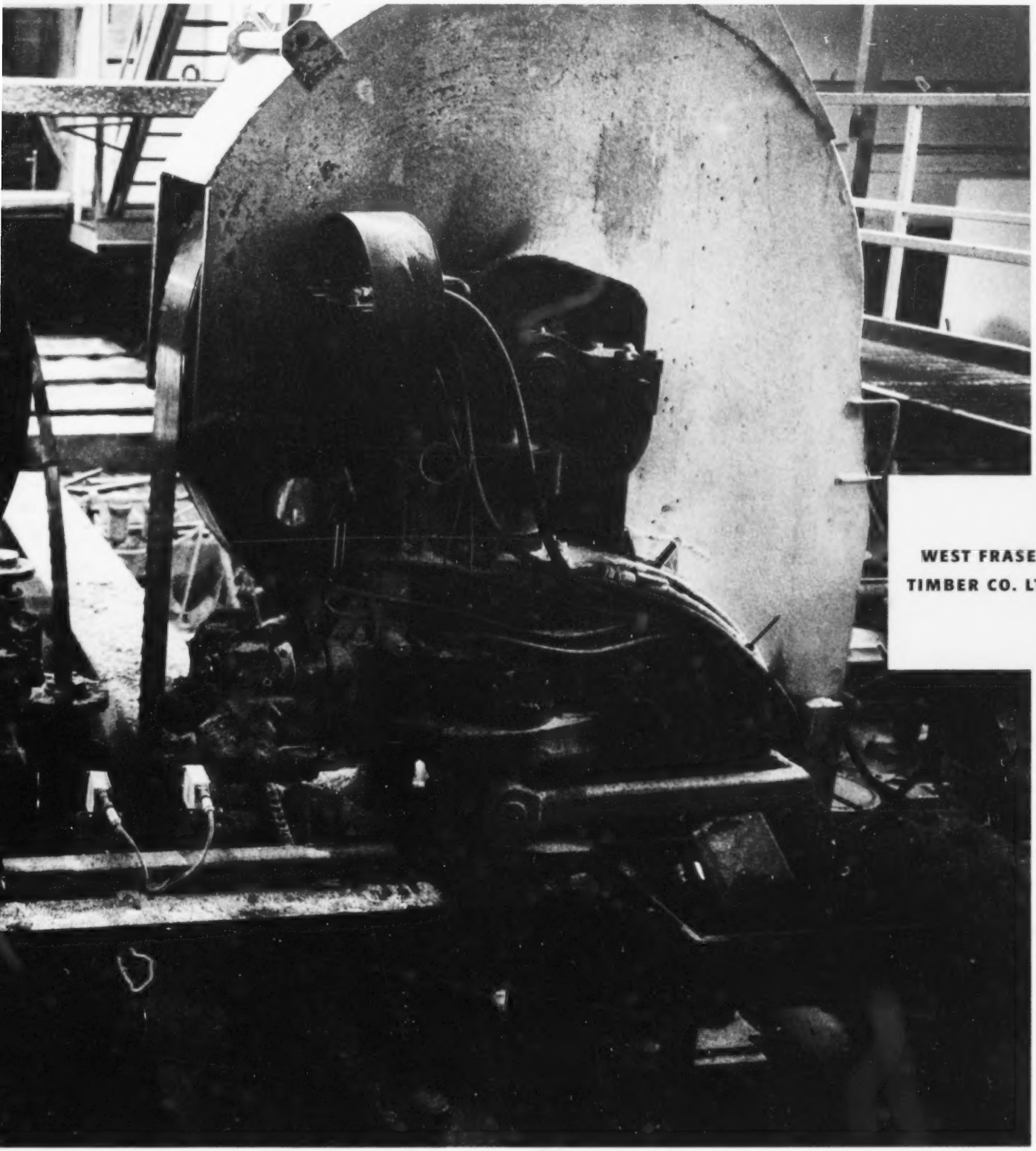
Unilever Rexdale's current target is to reduce its GHG emissions by 5 percent a year, and in 2003 it had already reduced its emissions by 11 percent compared with a 1999 baseline. With replication possibilities at nine other facilities in Canada and in its operations in 88 countries, Unilever is leading the pack with organization-wide commitment, team work and innovation.



WEST FRASER TURNS WASTE INTO OPPORTUNITY

While other forest products companies rely on wood waste as a substitute for fossil fuels, West Fraser Timber Co. Ltd. has taken a different approach. This integrated forest products company, which has operations in Alberta and British Columbia, is recovering mill wood waste and converting it into new products. By doing a better job of converting trees to lumber, the company today consumes 12 percent fewer logs to produce essentially the same lumber output as it did in 1990. It is also creating a "product sink" that locks CO_2 into valuable construction materials.

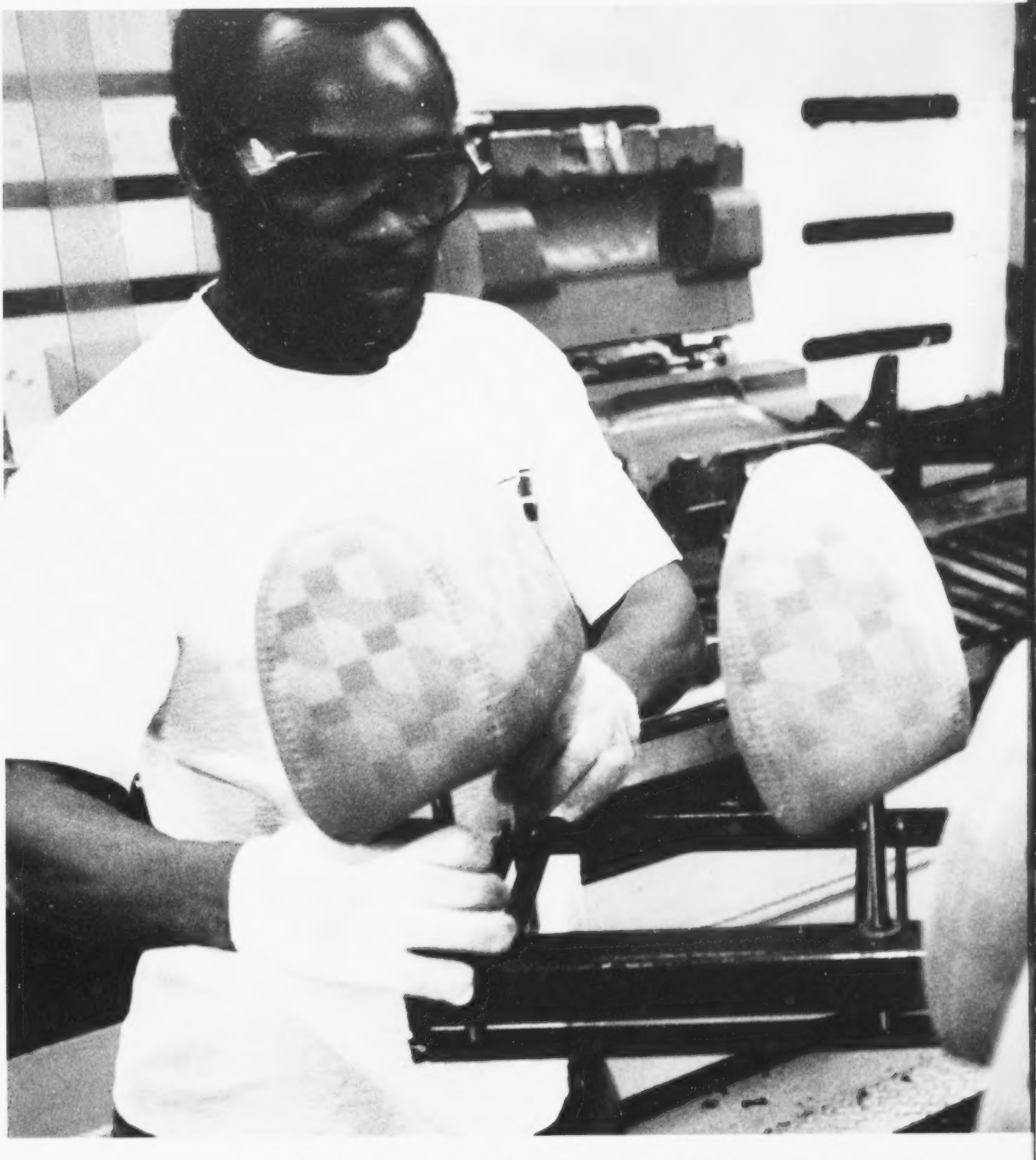
To facilitate this process, West Fraser expanded its medium-density fibreboard and sawdust pulp production to recover a greater percentage of sawmill scrap. This material would otherwise be incinerated, thereby releasing CO_2 into the atmosphere. At mills where



WEST FRASER TIMBER CO. LTD.

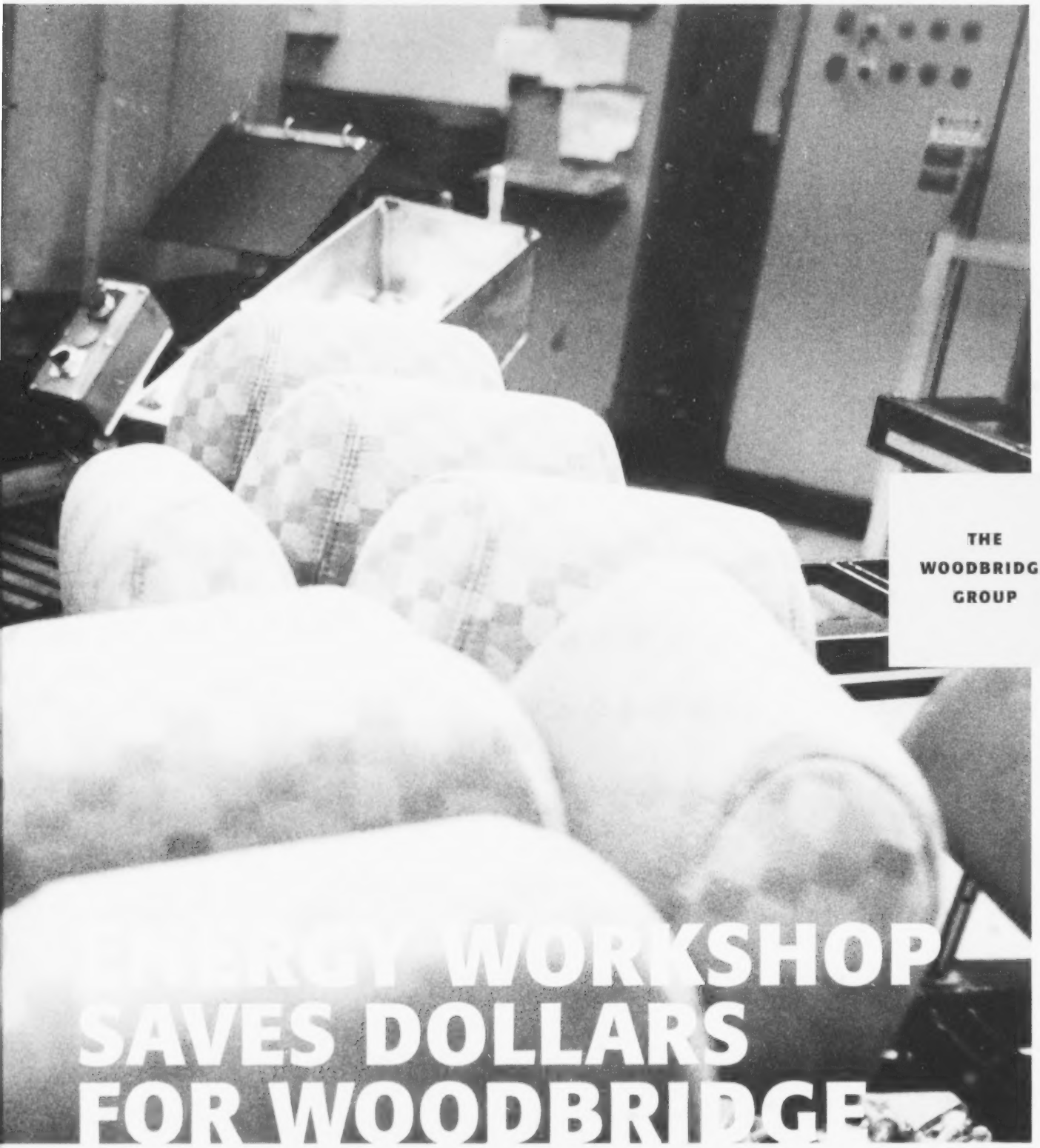
it cannot be converted to products, the company has found other uses for wood residue, including using it to generate kiln heat or as a fuel for power generation. Wood waste fuel at the company's facility in Fraser Lake, British Columbia, for example, has made the mill entirely self-sufficient for its heat and energy requirements.

West Fraser has also had significant success in its efforts to reduce fossil fuel consumption at its medium-density fibreboard plants. Thanks to fuel substitution, the company's West Pine plant in Quesnel, British Columbia, now produces less than a quarter of the CO_2-equivalent emissions it produced in 1997.



Industrial Energy Innovator The Woodbridge Group has turned a series of customized Dollars to $ense energy training sessions into a major cost savings opportunity. Delivered in over 50 locations worldwide in 2002, the sessions led to identifying an initial $600,000 in potential energy savings and the establishment of an energy management standard as part of the company's overall health, safety and environmental (HSE) management system.

A world leader in urethane automotive technologies, Woodbridge is committed to squeezing energy waste and has established energy reduction targets for all plants. The company has developed measurement tools to help it identify savings opportunities that



THE WOODBRIDGE GROUP

ENERGY WORKSHOP SAVES DOLLARS FOR WOODBRIDGE

include ultrasonic leak detection, a system to test the volume of leaks in a compressor system, and light meters to determine where lighting needs to be adjusted or upgraded. Woodbridge has also made improvements in its methodology for energy consumption and cost tracking, and it has established energy guidelines to be incorporated into the design of new plant facilities, plant projects and equipment selection.

The company realizes the importance of communication and employee participation to the success of its energy reduction program. To further increase awareness of energy use throughout the company, Woodbridge made energy the theme of its published 2003 HSE calendar and is having its employees' children create the artwork.

SECTOR REPORTS

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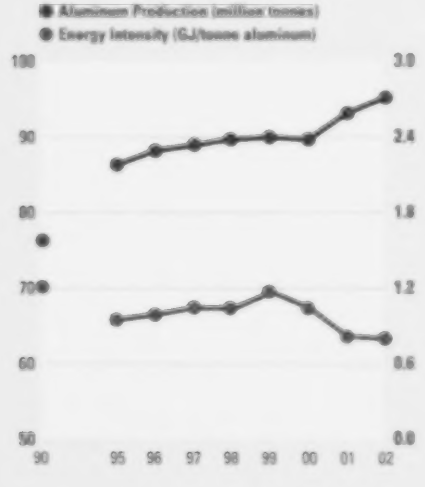
ALUMINUM

GHG emissions
DOWN 40%
per unit of production

The aluminum sector has kept its GHG emissions stable while ratcheting up primary aluminum production by 73 percent since 1990.

Aluminum Sector – NAICS 331313

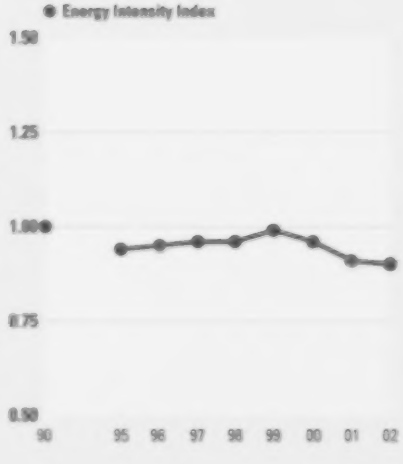
Energy Intensity and Physical Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Aluminum Sector – NAICS 331313

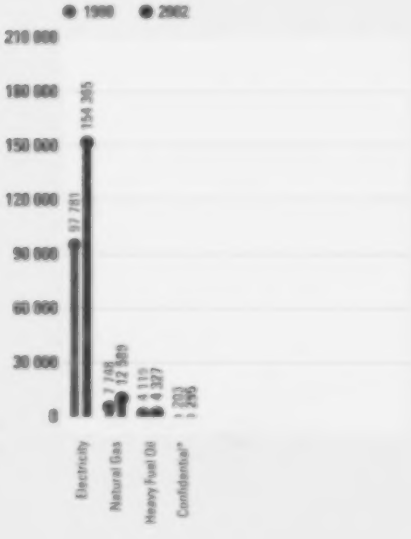
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Aluminum Sector – NAICS 331313

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

* Includes light fuel oil (middle distillates) and liquified petroleum gas (propane).

Profile In 2003, Canada's aluminum sector ranked third in the world in annual primary aluminum production. The combined output of the industry's 10 aluminum plants in the province of Quebec and one in British Columbia is a major contributor to Canada's national and local economies. Although production increases have forced the industry's total energy usage upward, measurements of energy intensity continue to demonstrate significant performance improvements compared with 1990 benchmark levels.

Actions

In 2002, the Aluminium Association of Canada and the Government of Quebec signed a voluntary GHG-reduction framework agreement that covers industry operations in Quebec. The agreement, which requires all parties to supply complete and verifiable audited data that accurately reflects the actual reductions achieved, establishes a process for the aluminum industry to improve its GHG emissions performance. Aluminum producers have agreed to conduct regular GHG audits to confirm the accuracy of the GHG emissions data they report. Audits will ensure that GHG statements have been prepared in accordance with a specified calculation methodology and are free of material errors. Audits were conducted at the end of 2003, and final reports should be published in early 2004.

To ensure the ongoing consistency of data developed and reported by its members, the Aluminium Association has prepared the *Greenhouse Gas Audit Manual*. The manual is designed to provide a general framework, principles and guidance for conducting GHG audits at aluminum production facilities. The *Greenhouse Gas Audit Manual* is available on-line from the Aluminium Association of Canada's Web site.

The industry was active on a number of other fronts in 2003. The industry held discussions with NRCan concerning the Government of Canada's reduction objectives for large final emitters and is confident that an agreement can be concluded in 2004.

Alcan has been working on reducing its GHG emissions since 1990. From 1990 to 1999, Alcan reduced total emissions from its smelting operations worldwide by 3 million tonnes of CO_2e. These results were realized primarily in Canada and are equal to a voluntary reduction of over 30 percent.

Aluminerie Alouette Inc. is investing $1.4 billion in a plant expansion that will boost its production capacity to 530 000 tonnes per year, making its facility the largest smelter in the Americas. The expansion includes the installation of AP30 technology, the world's most efficient technology for efficient electrolysis.

Alcoa Primary Metals has established an annual GHG reduction target of 200 000 tonnes in direct emissions between 2002 and 2004 compared with a 2001 base year. The company plans to achieve this objective by reducing energy consumption, intensifying the introduction of best practices, educating its work force, and, most significantly, taking steps to reduce anode effects. In 2002, the company's operations reduced GHG emissions by a combined 5.9 percent compared with 2001.

Electricity in Quebec is becoming less abundant, and the aluminium industry is making considerable efforts to improve its electrical energy efficiency. However, production increases due to market demand for aluminium continue to offset improvements in energy intensity. The industry's energy utilization factor is already above 98 percent, making it difficult to achieve significant additional energy efficiency gains. The industry believes that the early replacement of older technologies is the only significant option available to further reduce energy use.

Achievements

Primary aluminum production increased by 73 percent between 1990 and 2003, with the industry's GHG emissions remaining stable. Over the same period, the sector reduced its GHG emissions per unit of production by more than 40 percent of CO_2e per tonne produced. Since 1990, the aluminum sector has reduced its emissions of tetrafluoroethane (CF_4) and hexafluoroethane (C_2F_6) by approximately 10 percent.

On average, the industry reduced its CO_2e intensity from 5.59 tonnes of CO_2e per tonne of aluminum in 1990 to 3.33 tonnes in 2002. The industry expects that by 2010, overall intensity will be reduced further to 3.07 tonnes or lower.

Challenges

During the past four years, major changes have taken place in the aluminum industry; Alcoa Primary Metals bought Alumax and Reynold Metals and is now producing 39 percent of Canadian industry output. Alcan Inc. bought Algroup and put the 400 000-tonne Alma smelter into production. Alcan now owns 40 percent of Aluminene Alouette. These mergers, acquisitions and restructurings are expected to lead to new opportunities and challenges in 2004 and beyond.

BREWERY

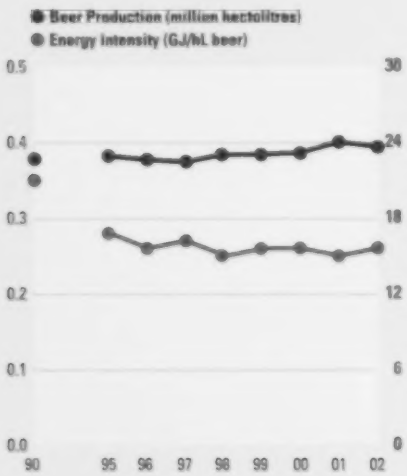
Sector reduces energy use

BY 24%

Canadian breweries use almost 24 percent less energy to brew beer than they did in 1990 and aim to further cut their energy use by 1.5 percent annually from 2004 to 2006.

Brewery Sector – NAICS 312120

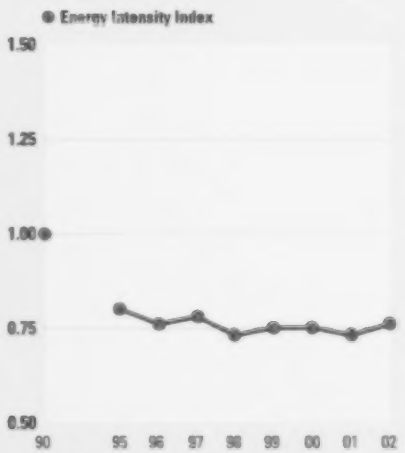
Energy Intensity and Physical Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Brewery Sector – NAICS 312120

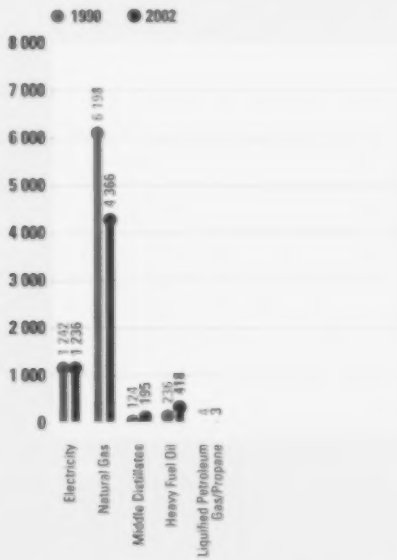
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Brewery Sector – NAICS 312120

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Profile **Canadian brewers pride themselves on many things: their world-class beers, their leadership in educating consumers to drink responsibly, their three-century history in Canada, their diversity and their impressive environmental record. The industry is made up of 79 breweries that in 2002 produced 23.5 million hectolitres of beer and employed more than 14 000 workers.**

Actions

The pursuit of energy efficiency is leading Canada's brewers to improve their beer-making processes, plant infrastructure and packaging activities, and to make capital investments in new bottle-washing and pasteurization equipment. Companies are upgrading heating, ventilating, lighting and air-conditioning systems, investing in the latest production process systems, and enhancing post-production shutdown procedures to trim waste.

Perhaps most important of all, brewers are creating an energy efficiency culture within their operations by focusing employee attention on conservation and entrenching local site, department and line accountability for energy and utility management throughout their organizations. For Canadian brewers, energy efficiency is a state of mind that starts with employees.

Action by employees to reduce energy use is encouraged. Some breweries use security staff to check for opportunities to save energy while they are making their rounds. Many breweries combine energy planning, monitoring and targeting with departmental accountability and employee participation in a comprehensive effort to maximize energy efficiency improvements.

Brewers conduct regular energy audits of steam and compressed-air systems to identify opportunities to eliminate energy waste. Companies are installing high-efficiency lighting, often controlled by motion sensors, to save energy. Air conditioning and ventilation are shut down in non-essential areas after hours, and crews ensure that equipment, steam, compressed air and utilities are turned off in entire areas of the brewery during idle periods. Others are using power conditioning to improve their power factors and are upgrading their CO_2 systems to achieve self-sufficiency.

Advances in ongoing monitoring, control and maintenance procedures are enabling breweries to identify and implement opportunities for improvement in their key processes and equipment. Extensive benchmarking helps to identify and implement best-practice approaches that cut production costs while improving energy efficiency. And capital projects are assessed to ensure that they incorporate energy efficiency strategies into their design and construction.

Achievements

The Canadian brewing industry is not classified as a large industrial emitter under Canada's climate change plan and is therefore not subject to covenants or emissions targets. Nevertheless, over the years the industry has made considerable progress in increasing its energy efficiency and achieving GHG emissions reductions in production and distribution.

Perhaps the largest source of avoided emissions is the brewing industry's packaging-reduction, re-use and recycling programs. The industry has attained a national packaging return rate of 97 percent for bottles and 85 percent for cans. This recovery rate has led to a dramatic reduction in energy consumption and a corresponding reduction in CO_2 emissions. In Canada, brewers recover about 13 036 tonnes of aluminum annually, thereby avoiding over 52 000 tonnes of CO_2-equivalent emissions.

Compared with 1990, the industry now uses almost 24 percent less energy to produce a hectolitre of beer. In 2002, the industry consumed 6219 TJ of energy, 70 percent of which was natural gas and 20 percent electricity. The brewing industry is committed to an energy-reduction target of 1.5 percent annually from 2004 through 2006.

Challenges

In an increasingly competitive marketplace, Canadian brewers continue to embrace opportunities to reduce expenditures without compromising their reputation for quality and innovation. Because energy is a substantial cost component in the brewing process, finding ways to improve energy efficiency remains a priority across the industry.

Faced with ever tougher international competition and the growth of other beverage categories, the industry is employing a combination of rigorous cost-management programs and innovative marketing strategies to maintain its strong position in the international marketplace. In fact, the success of Canada's brewers in pursuing international markets has made Canada one of the top beer exporters in the world.

With their innovative marketing concepts, aggressive approach to cost control and serious commitment to energy efficiency, Canadian brewers are well positioned to meet their competition head-on.

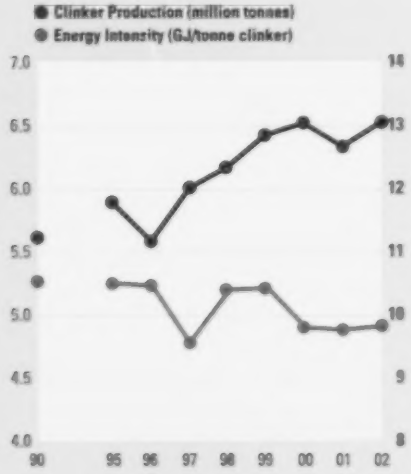
CEMENT

Plants improve KILN EFFICIENCY by 12%

The cement sector has reduced its overall energy intensity by 12 percent since 1990 while demand for its products increased 24 percent.

Cement Sector – NAICS 327310

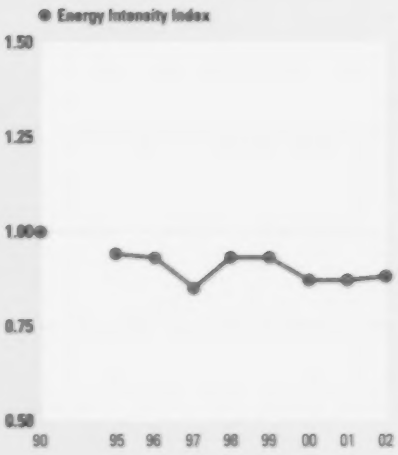
Energy Intensity and Physical Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Cement Sector – NAICS 327310

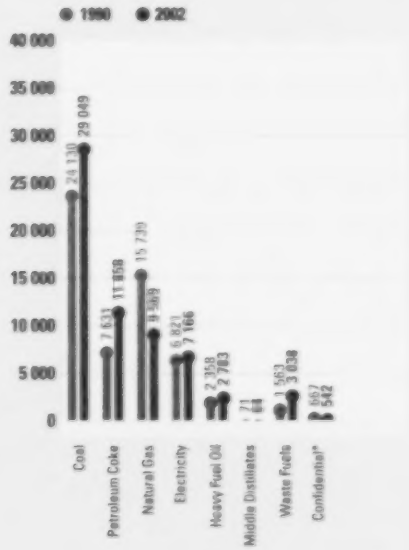
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Cement Sector – NAICS 327310

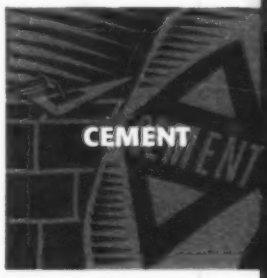
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

* Includes liquid petroleum gas (propane), coke and wood.

Profile The cement industry is the cornerstone of Canada's domestic construction industries and a significant exporter that contributes substantially to the country's balance of payments. According to Statistics Canada figures, the industry's eight companies, which operate 16 processing facilities, produced 13.0 million tonnes of clinker and 13.9 million tonnes of cement in 2002. Approximately 35 percent of production was exported to the United States.



Actions

At its meetings in 2003, the Cement Sector Task Force focused on sharing information about energy efficiency in non-core equipment such as compressed-air systems, fans and motors. To promote a best-practices approach to energy efficiency, the task force invited companies outside of the industry such as Syncrude Canada Ltd. and DuPont Canada Inc. to outline their energy management approaches. Of key interest to sector participants was how these companies engaged and motivated staff to manage energy use.

The sector also held discussions with NRCan about using Government of Canada combustion research facilities to study ways to improve burner design and reduce NO_x and SO_x emissions. Such research would supplement the work of individual sector companies that are already implementing actions such as kiln automation, raw-mix quality enhancements and improvements in operating practices that are known to lower NO_x emissions.

Although few major investments in energy efficiency were made by the industry in 2003, cement companies across Canada continued to focus on waste-fuel substitution and raw material replacement and on the reduction of power consumption. Significant opportunities exist for the displacement of fossil fuels by tires, plastics and selected segments of municipal solid waste. The industry also continues to advance efforts to incorporate slag as a raw material.

Individual cement manufacturers continue to implement actions to improve energy efficiency. For example, St. Lawrence Cement Inc. is assessing plant "fitness" and is identifying ways to optimize processes to reduce its overall heat and electricity requirements. The company is actively developing and marketing mineral substitutes for clinker in efforts to reduce the energy component in cement while improving the properties of concrete. St. Lawrence Cement is also pursuing the use of alternative, waste-fuel sources such as used oil, solvents, automobile tires and biomass. This practice cuts GHG emissions by displacing fossil fuels with materials that would otherwise be incinerated or sent to landfill. By the end of 2002, environmental programs underway at St. Lawrence Cement had reduced CO_2 levels by 19 percent compared with the 1990 base year.

Achievements

Canada's cement sector improved its kiln efficiency by 12 percent between 1990 and 2002. Total GHG emissions, including process emissions, per tonne of cementitious product were 7.1 percent lower over the same period. The Cement Association of Canada projects a further 2 percent decrease in GHG intensity per unit of production by 2010.

Since 1990, the cement sector has reduced its overall energy intensity by 12 percent while demand for its products increased 24 percent. The cement industry anticipates that ongoing plant modernization combined with expanded use of power monitoring, targeting and other systems and technologies will continue to produce further energy efficiency improvements.

The cement industry also believes that concrete presents a tangible long-term solution to environmental issues and to the creation of sustainable, durable infrastructure. For example, the intelligent use of cement-based products in the transportation, residential housing and agriculture sectors can improve energy efficiency and reduce GHG emissions in these sectors, thereby supporting Canada's Kyoto Protocol goals.

Challenges

Energy for fuel and power comprises 35 to 40 percent of the cost of producing cement. Upwardly spiralling prices for clean fuels, such as natural gas, are forcing cement makers to look to other sources of energy to control costs. In 2002, the sector significantly increased its use of petroleum coke, coal and other fuels at the expense of natural gas. Indeed, the last two plants in Canada to burn natural gas were converted in 2002 to coal – a cheaper fuel. Driven by the need to remain price-competitive in an increasingly international industry, cement companies across Canada have intensified their efforts to utilize alternative fuels (such as waste tires and plastics) while seeking to reduce GHG emissions.

Market demand is a significant factor in the sector's energy efficiency. Energy-intensive cement production processes are most efficient when operating as closely as possible to full capacity, and weakness in demand can trigger corresponding declines in cement plant throughput. Therefore, the sector's energy efficiency and GHG emissions performance are directly linked to its success in maintaining high levels of sales. To a certain extent, the trend of using fuels that are less expensive than natural gas helps to keep the Canadian industry operating at more energy-efficient levels and, therefore, price-competitive.

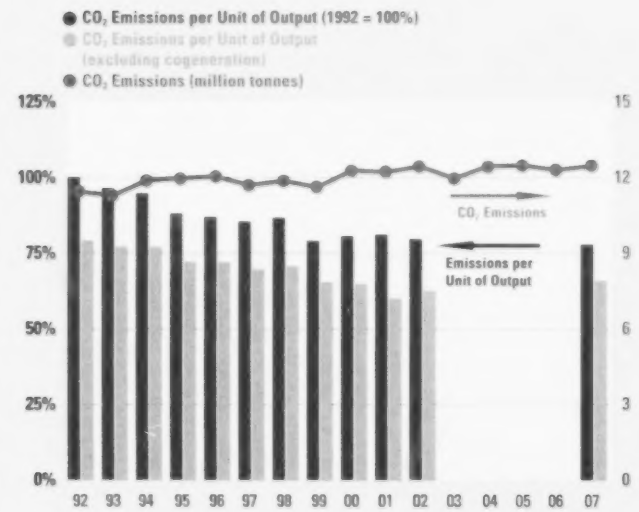
CHEMICAL

Industry adds 1500 MEGAWATTS of cogeneration capacity

Between 1992 and 2002, Canadian chemical producers cut their GHG emissions by 36 percent.

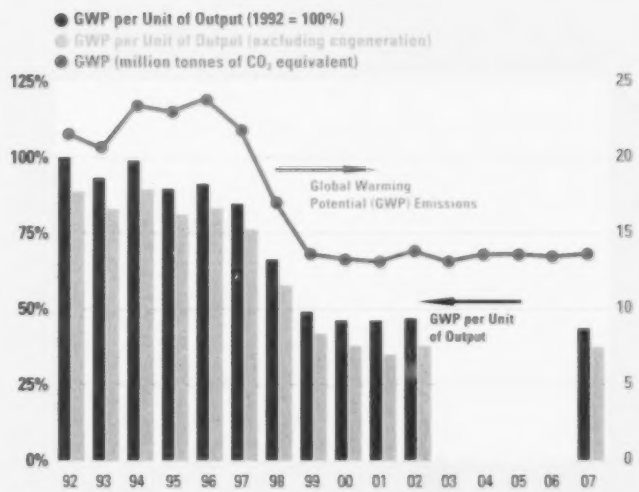
Chemical Sector – NAICS 3251, 3252[1]

Carbon Dioxide Emissions vs. Product Output from CCPA Member Operations



Chemical Sector – NAICS 3251, 3252[1]

Global Warming Potential vs. Product Output from CCPA Member Operations



[1] NAICS 3251 includes basic chemicals, NAICS 3252 includes resins, synthetic rubber and artificial and synthetic fibres and filaments.

Profile The chemical sector encompasses a diverse industry that produces organic and inorganic chemicals, plastics and synthetic resins. The chemical industry is the third largest industry in Canada in terms of value of shipments. Companies in this sector operate 472 facilities Canada-wide, directly employing more than 24 000 people, with an annual payroll of $1.4 billion. The Canadian Chemical Producers' Association (CCPA) is the trade association that represents manufacturers in this sector. Its member companies produce more than 90 percent of industrial chemicals manufactured in Canada.

Actions

The CCPA is working at both the federal and provincial levels to develop a process for the sector that contributes to Canada's climate change goals while maintaining the industry's international competitiveness and providing growth and jobs for Canadians. At the same time, the industry encourages companies to be continually on the lookout for opportunities to save energy. For example, several CCPA member companies have taken advantage of the considerable benefits of cogeneration technology. Over 1500 MW of cogeneration capacity will be added to existing capacity in the chemical sector between 1997 and 2005. This will improve energy efficiency and reduce the amount of CO_2 emitted per unit of energy produced while abating CO_2 emissions in the utility sector by offsetting emissions from coal- or oil-fired power plants.

As part of a joint venture, NOVA Chemicals installed a 416 MW natural-gas-fired cogeneration plant at its manufacturing facility in Joffre, Alberta. Proprietary high-temperature alloy coatings developed at NOVA Chemicals' Calgary Research and Technology Centre are used in cracking furnaces at the site to reduce the rate of carbon buildup inside furnace tubes, improve heat transfer rates, prolong intervals between tube de-coking operations, reduce GHG emissions and improve energy efficiency. When operating at capacity, the cogeneration facility produces less than half the average CO_2 emissions that would be generated by using conventional power from the Alberta grid, most of which is produced by coal-fired generation. NOVA Chemicals' goal is to reduce its net emissions intensity from its Canadian chemical facilities by 25 percent below 1999 levels by 2005.

A wastewater recovery project at Huntsman Corporation Canada Inc.'s plant in Guelph, Ontario, now returns condensate to the facility's boilers for re-use, resulting in significant decreases in water and energy consumption. The project has reduced water consumption by over 32 million kilograms per year, has substantially cut boiler fuel use, and has led to reductions in SO_2, CO, NO_x and CO_2 emissions of over 350 tonnes per year.

DuPont Canada Inc. exceeded its 2005 goal of reducing its energy use by 15 percent through documented energy conservation measures. The company accelerated its energy conservation projects through performance contracting, and by the end of 2002 – three years ahead of schedule – it had achieved a cumulative reduction of 1550 TJ since 1995. This progress is expected to continue for the next few years.

Dow Chemical Canada Inc. has undertaken projects in a number of areas, including operational changes, to improve its overall energy efficiency and reduce GHG emissions. The company's voluntary reduction of emissions, including GHGs, chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), has resulted in a 50 percent reduction since 1990. During that time frame, energy efficiency and cogeneration initiatives enabled the company to avoid an estimated 24 million tonnes of CO_2 emissions.

Shell Chemicals Canada Ltd.'s mono-ethylene glycol plant at its facility in Scotford, Saskatchewan, was designed to minimize GHG emissions. The plant incorporates synergies with air separation, CO_2 recovery and cogeneration plants, all operated by neighbouring Air Liquide Canada Inc. Thanks to the new plant, emissions intensity at the site dropped from a high of 1.31 tonnes of CO_2e per tonne of production in 1993 to 0.49 tonne in 2002. Projections for the years 2003 to 2007 show further reductions in emissions intensity. Since the company's baseline year of 1990, total GHG emissions have been reduced by 1 percent, or 4000 tonnes of CO_2e, while plant output has increased nearly two and a half times.

A variety of energy efficiency programs at Solutia Canada Inc.'s facility in LaSalle, Quebec, have led to dramatic reductions in energy consumption and emissions. Between 1995 and 2001, the company reduced its GHG emissions by 34 percent.

Achievements

The sector's product output has increased by over 36 percent since 1992. At the same time, total CO_2 emissions from CCPA members from 1992 to 2002 have increased by 9 percent, and CO_2e emissions, excluding emissions from cogeneration plants, have increased by 8 percent. In terms of global warming potential, member companies' GHG emissions – including CO_2e – in 2002 have declined by 36 percent based on 1992 amounts.

Challenges

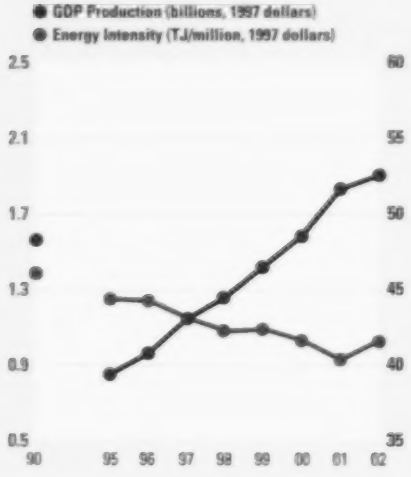
CCPA members face an ongoing challenge to reduce GHG emissions while accommodating the needs brought by growth. Canada's participation in the Kyoto Protocol has made this challenge more complex. As integral players in an international market, Canadian facilities continually invest capital to remain competitive with other regions. These investments frequently affect energy efficiency and GHG emissions. In addition, this global industry is actively researching ways to further reduce energy consumption, change feedstock streams and commercialize new processes. In the aggregate, this work could significantly contribute to a reduction in future GHG emissions intensities.

Sector launches GREEN BUILDINGS task force

The construction sector is a leader in adopting and implementing environmentally sound business practices.

Construction Sector – NAICS 230000[1]

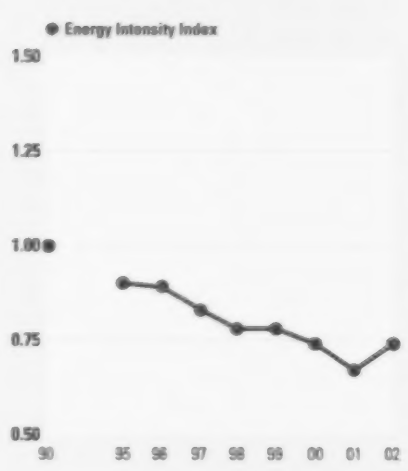
Energy Intensity and Economic Output (excluding electricity) (1990–2002)



Data source: Statistics Canada, *Quarterly Report on Energy Supply-Demand in Canada, 1990–2002. A Review of Energy Consumption and Related Data: Canadian Construction Industry 1990–2002*, CIEEDAC, November 2003.

Construction Sector – NAICS 230000[1]

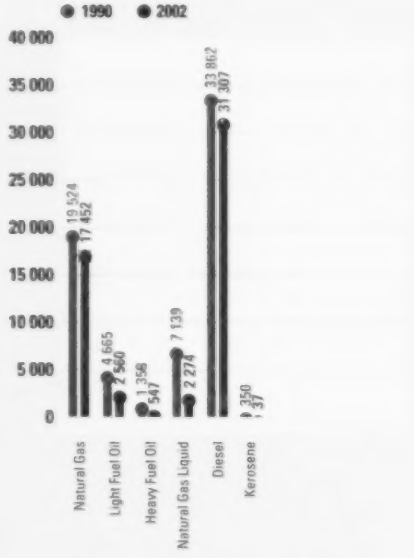
Energy Intensity Index (excluding electricity) (1990–2002) Base Year 1990 = 1.00



Data source: Statistics Canada, *Quarterly Report on Energy Supply-Demand in Canada, 1990–2002. A Review of Energy Consumption and Related Data: Canadian Construction Industry 1990–2002*, CIEEDAC, November 2003.

Construction Sector – NAICS 230000[1]

Energy Sources in Terajoules per Year (TJ/yr.) (excluding electricity)



Data source: Statistics Canada, *Quarterly Report on Energy Supply-Demand in Canada, 1990–2002. A Review of Energy Consumption and Related Data: Canadian Construction Industry 1990–2002*, CIEEDAC, November 2003.

[1] NAICS 236 includes buildings; NAICS 237 includes heavy and civil engineering construction; and NAICS 238 includes specialty trade contractors.

Profile The construction sector is Canada's largest industry, comprising a diverse array of companies whose work touches every economic sector and region of the country. The construction industry employs a work force of more than 950 000 and generates $134 billion in annual economic activity – about 12 percent of Canada's GDP.

Actions

The construction sector is represented within CIPEC by the Canadian Construction Association (CCA), the national voice of the construction industry, with a membership of more than 20 000 enterprises. CCA members comprise all segments of the construction industry, from design and management to building and general contracting. The construction industry is keenly aware of the importance of energy efficiency and the role it plays in business success and in protecting the environment.

Over the years, the industry has earned a place as a leader among industrial sectors in adopting and implementing environmentally sound business practices. For example, sector companies are active participants in the design and construction of the Earth Rangers Centre, located at the Kortright Centre for Conservation in Vaughan, Ontario. Intended to inspire children to take positive action toward a sustainable world, the Earth Rangers Centre will be the world's most advanced wildlife centre as well as Canada's most energy-efficient building. Ventilation will incorporate buried "earth tubes" that use the earth's natural warming and cooling properties to temper air before it enters the building. The Earth Rangers Centre will also be the first building in Canada to be heated and cooled entirely by thermally activated radiant slabs. Humidity will be controlled using an innovative liquid desiccant dehumidifier. Using these and other energy-saving materials, technologies and advanced design concepts, the 3280-m² facility will use only 39 percent of the energy of a similar building designed according to the *Model National Energy Code*.

In February 2003, Walward Steel Fabricators Ltd. of Edmonton, Lockerbie & Hole Industrial Inc. of Sherwood Park, Alberta, and the University of Alberta signed a project charter aimed at reducing GHG emissions in the construction industry. Working with CIPEC and with help from Suncor Energy Inc. and Shell Canada Products Limited, the organizations are undertaking a comprehensive project that includes voluntary compliance reporting, GHG-reduction strategies and supply chain management within an overall environmental plan. In May 2003, the consortium was joined by Edmonton-based Enviro Abled Solutions Inc., a firm with expertise in artificial intelligence software. The joint project is the first of its kind in the construction industry.

In 2003, CCA joined forces with the Royal Architectural Institute of Canada, the Building Owners and Managers Association of Canada, and the Association of Consulting Engineers of Canada to form the Industry Task Force on Green Buildings. The group's mandate is to work with the Government of Canada to find ways to encourage energy efficiency in the non-residential building sector. In August 2003, the Government of Canada announced a $129 million incentive program for the "greening" of non-residential buildings, a program that focuses heavily on energy efficiency.

In 2004, the sector will focus on improving energy efficiency in the road-building and heavy construction industries, and in January, CCA and CIPEC began work on an energy reduction guide for road-builders. To encourage further movement toward energy efficiency, CCA is urging the Government of Canada to expand its energy efficiency rating program to include heavy equipment and to create incentives for the purchase of fuel-efficient equipment.

Achievements

The construction industry's energy consumption is directly related to levels of construction activity. The industry recorded a marginal decline in gross output in 2003 of 0.3 percent. However, growth for 2004 is estimated at a strong 4.5 percent, followed by 3.9 percent in 2005 and 2.0 percent in 2006.

For 2004, engineering construction is by far the sector's growth leader, with an increase in activity of 7.5 percent. Non-residential building construction and repair construction will likely see 4.3 percent and 3.3 percent growth, respectively. Residential construction is expected to be limited to a less robust but respectable 2.6 percent growth as a result of expected higher interest rates and softer demand.

Challenges

Construction sector companies are continually on the lookout for equipment, materials and practices that can lower costs and reduce GHG emissions. However, economic considerations play a major role in the industry's ability to invest in energy efficiency. Motorized vehicles, machinery and heavy equipment are expensive, requiring companies to make major capital commitments. Given the competitiveness and unpredictability of the construction industry, the desire to upgrade must compete with the need to maximize the return on existing machinery. Balancing these needs often impedes advances in energy efficiency.

Similarly, the sector's diversity makes it difficult to develop generic energy efficiency programs that are meaningful and practical. What works in constructing roads may not apply to building factories and bridges or to designing and engineering new projects. However, CCA is committed to encouraging its members to become Industrial Energy Innovators and to take advantage of opportunities to improve their energy efficiency. CCA believes that over time its participation in CIPEC will help to accelerate improvements in the environmental performance of Canada's construction industry.

DAIRY

Putting energy EFFICIENCY TOOLS to work

The Dairy Sector Task Force is committed to helping sector companies develop sound business cases for investments in energy efficiency.

The sector is currently working with NRCan's Office of Energy Efficiency to develop indices and figures.

Profile Canada's dairy product manufacturing sector spans Canada from coast to coast, operating more than 270 facilities and employing 20 500 people. In 2002, Canada's dairies processed 71.6 million hectolitres of raw milk and shipped an estimated $9.89 billion worth of milk products.

Actions

Energy is a key component in milk processing, and sector companies are taking action to improve energy efficiency and control costs. For example, Parmalat Dairy & Bakery Inc. reduced its corporate energy consumption by 3 percent in 2003 through improvements to its steam, refrigeration and air compressor systems. The company introduced better management of its steam load, enabling it to take a 300-hp boiler off-line. Additional efficiencies were gained through various heat and condensate recovery projects and by replacing failed steam traps. Parmalat reduced the energy consumption required for the refrigeration systems at two of its plants. The company realized savings with its compressed-air systems by redesigning inefficient processes, fixing leaks and taking unnecessary compressors off-line. As well, Parmalat completed customized energy efficiency training at a number of its facilities across Canada.

By improving how it collects energy data, Atwood Cheese Company in Atwood, Ontario, was able to correlate its energy consumption with the type of cheese it produced, thus reducing its peak energy demands. The company improved the efficiency of its boilers using retrofits and by lowering flue gas temperatures. Atwood also installed sun protection on windows to reduce cooling demand, introduced high-efficiency equipment to its operations and began retrofits to its lighting. The company's principal energy savings came from controlling its use of compressed air, reducing its boilers' use of natural gas and replacing a chemical cleaning system with an enzymatic process.

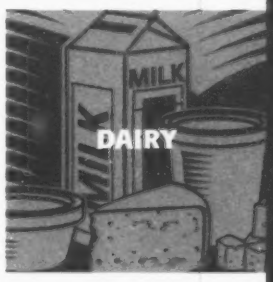
Saputo Inc. has improved its energy data collection and compilation – a process that includes meter readings and energy intensity calculations – at all of its plants. The company is now using its new-found data to benchmark performance. The company has also increased the number of energy audits it performs and is launching new energy awareness campaigns at its plants to make energy consumption issues more visible within the company.

An energy audit at Island Farms Dairies Co-operative Association of Victoria, British Columbia, led to an increase in the automation of its refrigeration control systems and allowed it to take one of its air compressors off-line. Additional energy savings were realized by adding a variable speed drive to the control system of one of the remaining compressors. Variable speed drives were also added to each of three pumps on the plant's clean-in-place (CIP) system, thereby improving the energy efficiency of these pumping systems. Before this upgrade, control valves were modulated to control flow. But perhaps the most valuable outcome of its energy audit was the information provided to assist in the development of a business case for additional energy initiatives.

Gay Lea Foods Co-operative Limited's plant in Guelph, Ontario, has reduced its use of city water by transferring surplus water from its drying process to its butter plant. At its plant in Toronto, Ontario, the company is installing a new, energy-efficient boiler and is refurbishing its old boiler for backup use. An audit at the plant has led to the improvement of its compressed-air systems, thereby increasing capacity without adding system horsepower.

Achievements

This year, the Dairy Sector Task Force has decided to be tracked by the energy performance data collected for the Food and Beverage Sector Task Force, of which the dairy industry is a constituent member.



Beginning with 2001 data, when the dairy sector's NAICS classification (311 500) exhibited an approximate 30 percent improvement in energy performance, the sector withheld this number from the CIPEC annual report because the figure was considered suspect. The Dairy Sector Task Force is working with Statistics Canada to identify why such large fluctuations occur in the sector's energy data. The problem appears to develop from a number of factors, including high turnover in the sample due to the large size of the population and the weighting of the various types and sizes of facilities, used to determine energy consumption under this NAICS code. When a solution is agreed upon, it will be applied to past and future data arrays, enabling the sector to once again report dairy-specific energy performance indicators.

Challenges

The Dairy Sector Task Force is focused on increasing company participation in energy efficiency initiatives. Many manufacturers have already made the most of the low-cost and no-cost energy efficiency improvements available to them. This, combined with unstable energy prices and the competitiveness for capital, makes developing a sound business case for investments in energy efficiency a significant challenge. Moreover, the rationalization and competitive pressures that have emerged in recent years continue to drive the industry to downsize facilities in the face of static sales. The industry's greatest challenge now is to make the more costly and payback-delayed improvements that will further advance energy efficiency.

Complicating the sector's energy efficiency picture is a growing demand for innovative, high-quality and energy-intensive products. For the dairy industry, creating these value-added products often conflicts with efforts to improve energy efficiency.

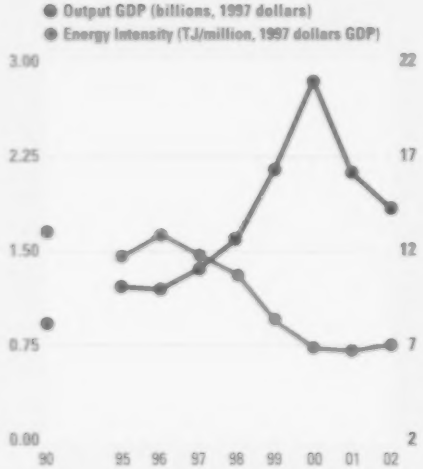
ELECTRICAL AND ELECTRONICS

Energy intensity
DROPS 54%
since 1990

Between 1990 and 2002, the sector decreased its energy consumption despite a substantial growth in production. The result is a 54 percent improvement in energy intensity.

Electrical and Electronics Sector – NAICS 334, 335[1]

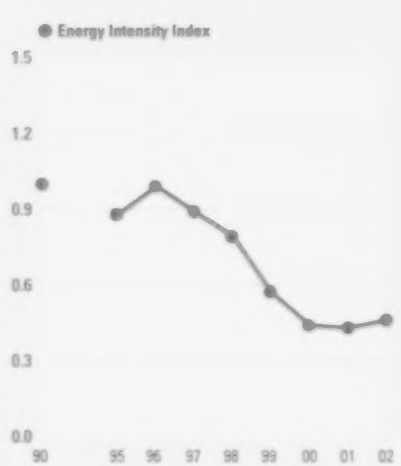
Energy Intensity and Economic Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University.

Electrical and Electronics Sector – NAICS 334, 335[1]

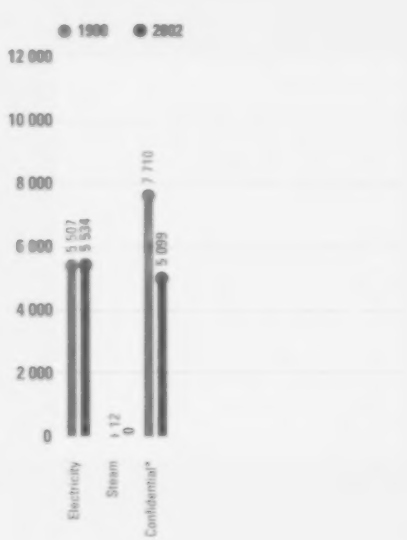
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University.

Electrical and Electronics Sector – NAICS 334, 335[1]

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University.

* Includes natural gas, heavy fuel oil, light fuel oil (middle distillates) and liquified petroleum gas (propane).

[1] Computer, Electronic Products, Electrical Equipment and Appliance Manufacturing.

Profile The electrical and electronics sector includes a diverse array of companies that produce electrical appliances, lighting, consumer electronics, communications and electronic equipment, cabling, office equipment, industrial equipment and other electrical products. These companies operate more than 1400 facilities and employ more than 100 000 workers across Canada. The industry is a major exporter and a vital, growing contributor to the national economy.

Actions

Despite their relatively light use of energy based on per unit of production, companies in the electrical and electronics sector are strong proponents of environmental sustainability and energy efficiency.

For example, in 2002, IBM Canada Ltd. achieved exceptional company-wide energy conservation results. The company reduced its overall energy consumption by 5.14 percent and its energy consumption density (MWh/sq. ft. per year) by 4.8 percent. IBM Canada cut its actual CO_2 emissions associated with energy consumption by 5.13 percent, and energy saved due to energy efficiency measures was 21 522 MWh, representing avoided CO_2 emissions of 4225 tonnes. By the end of 2002, the company's cumulative CO_2 emissions reduction from the base year, 1990, was 39 488 tonnes. GHG emissions in 2002 resulting from the use of Fluorinert F-C 40 – a perfluorocarbon – were reduced by 86 percent compared with 1995. The company continued to implement energy conservation projects in 2003.

Achievements

Natural gas and electricity satisfy virtually all of the electrical and electronics industry's energy requirements. In 2002, the industry consumed 10 634 TJ of energy, representing 0.4 percent of the energy consumed by Canada's mining and manufacturing companies as a whole and less than 1 percent of total energy-related CO_2 emissions in the manufacturing sector. On average, energy expenditures represent less than 1 percent of the value of the industry's shipments, compared with more than 61 percent for materials and supplies and 16 percent for labour.

Between 1990 and the end of 2002, the sector's overall energy consumption decreased despite substantial growth in production. These factors have combined to decrease energy intensity by just over 54 percent. Acquisitions, mergers and internal rationalization are enabling the industry to realize increased efficiencies of scale, which are expected to lead to a significant decrease in energy consumption in the coming years.

Sector companies contribute to Canada's overall energy efficiency and GHG-reduction programs in other ways. Many sector products, from oil-refinery control systems to high-efficiency motors and lighting, are used by companies in other sectors to decrease their energy consumption.

The electrical and electronics sector is one of Canada's least energy intensive industries and a disproportionately high exporter – factors that link its response to energy management challenges more closely to global economic realities, international capital investment trends, interest rates and productivity issues. Energy efficiency improvements within the sector are a direct result of a higher manufacturing capacity utilization and productivity gains within the sector. Fortunately, as other industries move to achieve productivity gains and greater energy efficiency, demand for products from the electrical and electronics sector increases, thereby improving the sector's economies of scale and energy efficiency.

Challenges

During the second quarter of 2003, the Canadian economy stumbled because of several factors, including SARS, mad cow disease, forest fires, storms and a major power outage in Ontario. More significant over the long term is the Canadian dollar's rapid appreciation versus the U.S. dollar, producing a pattern of weaker economic activity. This weakness is expected to continue over the next year as Canada absorbs the impact of recent events and as export industries, such as the electrical and electronics sector, adjust to a soaring currency.

Because of pent-up demand, a strong housing market and a robust energy sector, the industry expects that domestic demand will support many companies in the sector in the coming months. However, the energy management challenges faced by the sector are largely the result of global economic factors and the subsequent decrease in the availability of investment capital for energy conservation projects. Around the world, prices are restrained by excess global manufacturing capacity, soft demand, weak job markets, low interest rates and productivity gains. A weak corporate profit picture inevitably leads to tighter capital investment controls, especially for spending on machinery and equipment. Nevertheless, thanks to productivity gains and greater internal efficiencies, the electrical and electronics sector continues to lead other manufacturing sectors in decreasing its energy use and intensity.

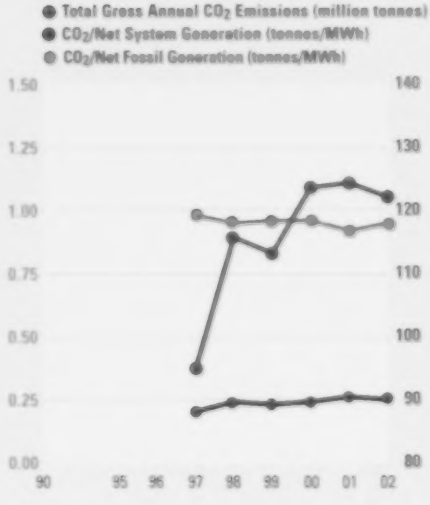
ELECTRICITY GENERATION

Companies invest
$750 MILLION
in energy programs

Between 1991 and 2000, the sector invested approximately $750 million in demand-side energy management programs. Another $1 billion is earmarked for the next 8 to 10 years.

Electricity Generation Sector – NAICS 22111

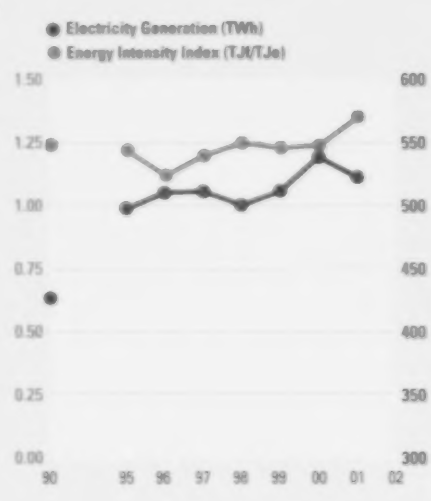
Utility Carbon Dioxide Emissions vs. Utility Production (1997–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *A Review of Energy Consumption and Production Data: Canadian Electricity Generation Industry 1990–2002*. January 2004.

Electricity Generation Sector – NAICS 22111

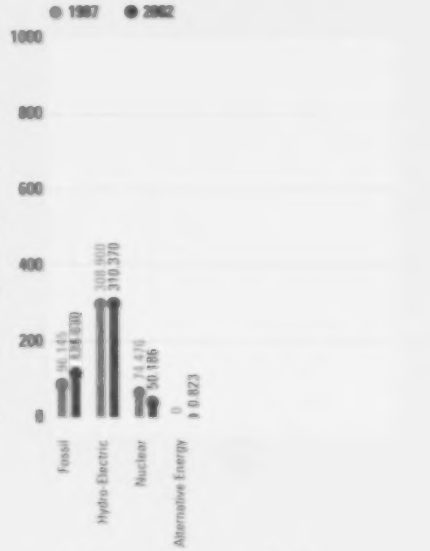
Utility Production and Energy Intensity (1990–2001)



Data source: Canadian Electricity Association. Environmental Commitment and Responsibility (ECR) Program 1997–2002. *2002 ECR Annual Report*.

Electricity Generation Sector – NAICS 22111

CEA Utility Generation Sources in TWh (1997–2002)



Data source: Canadian Electricity Association. Environmental Commitment and Responsibility (ECR) Program 1997–2002. *2002 ECR Annual Report*.

Profile The electricity generation sector produces the electrical energy that powers industry, business and homes across Canada. Using water, fossil fuel, nuclear energy and alternative energy sources, the sector produced 560.9 TWh in 2003, meeting Canada's domestic energy needs while earning more than $1 billion in export revenues.

Actions

The Canadian Electricity Association (CEA) believes that demand-side management and related energy efficiency strategies are key components of the industry's ongoing efforts to ensure the most effective use of Canada's electricity system and reduce the environmental impacts of its operations. CEA has pursued energy efficiency gains and GHG emissions reductions through joint efforts with government on consumer education and emerging renewable technologies.

The effectiveness of consumer-oriented energy efficiency programs will be greatly improved if feedback to customers on their electricity consumption is enhanced. The introduction of electronic meters through the CEA's Electricity Measurement Accuracy Program will significantly increase this capability. Electronic meters can provide customers with real-time information on their energy use and prevailing rates. Customers can then better manage their energy costs by reducing consumption at high-cost peak times and by investing in more efficient appliances.

Sector companies are committed participants in the CEA's Environmental Commitment and Responsibility (ECR) Program. This program was established by the industry in 1997 to address a wide range of environmental issues, including energy efficiency, climate change, air quality and stewardship on an industry-wide basis. Participation in the ECR Program is a requirement for corporate utility membership in CEA. CEA also supports the initiative of members, who, through the Canadian Clean Power Coalition (CCPC), have proposed an industry-government partnership for research, development and demonstration of commercially viable clean coal technology.

Individual companies are also advancing an energy efficiency agenda. For example, Nova Scotia Power Inc. is working to improve generation efficiency, thereby increasing the amount of power it can sell. The company is looking to upgrade and install equipment where long-term gains due to improved efficiency outweigh initial costs. Nova Scotia Power is also studying ways to increase efficiency by determining the best fuel blends to use with each of its boilers. The company estimates that efficiency improvements can range from less than 1 percent for hydro stations and wind turbines to approximately 10 percent for more complex thermal generating stations. In 2002, Nova Scotia Power set a voluntary target to reduce its GHG emissions intensity by more than 10 percent by 2012 compared with 1990 values.

In 2002, Manitoba Hydro introduced its Power Smart Eco-Efficiency Solutions Program for industrial customers. To date, eight customers have participated in the unique pilot program, which enables plants to define measures to improve environmental performance. Combined, these customers consume $28 million worth of energy and generated 0.475 megatonne of GHG emissions per year. Several participating companies identified specific measures to reduce energy consumption, leading to cost savings and emissions reductions. Manitoba Hydro has committed to reducing its GHG emissions by more than 6 percent below 1990 levels by 2012.

Between 1994 and 2002, Ontario Power Generation achieved internal energy savings of 2411 GWh, which represents monetary savings of more than $105 million (at $0.043 per kilowatt hour) and an annual emissions reduction of 2.3 million tonnes of CO_2, NO_x and SO_2.

Achievements

In 2002/2003, CEA conducted a survey in partnership with NRCan of its members' energy efficiency programs. The survey, which examined the expenditures and energy savings associated with past, present and forecasted demand-side management energy programs, yielded impressive results. Between 1991 and 2000, approximately $750 million was invested in programs aimed at reducing energy use, with a further $1 billion earmarked over the next 8 to 10 years. Demand-side management programs in the 1990s resulted in a reduction of 4 megatonnes of CO_2 emissions, with a further 4-megatonne reduction expected by 2012. A letter of cooperation between CEA and NRCan is being developed to provide a framework within which industry and government can collaborate and harmonize their respective activities related to end-use energy efficiency.

Challenges

Energy efficiency gains in the electricity generation sector are achieved largely by replacing existing capital stock, which involves large investments and long turnover cycles. This makes it difficult to record immediate year-over-year improvements. Moreover, as a number of provincial markets move toward deregulation, increasing competition presents opportunities and risks. Companies are striving to adopt emerging new business models and adapt to a rapidly evolving industry structure. At the same time, they are seeking to gain a competitive advantage while integrating energy efficiency opportunities and cost reductions into their operations.

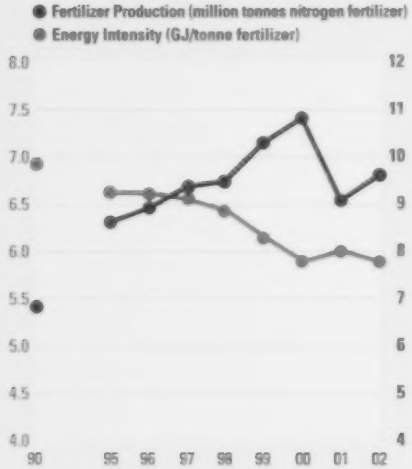
Of paramount concern to the sector is balancing increases in energy efficiency with the need to provide customers with a reliable, affordable source of energy. The demand for electricity is growing due to economic and population growth as well as structural factors, such as changing production processes and evolving consumer preferences. Combined, these factors make it more complex for the industry to improve its energy efficiency.

Energy efficiency
IMPROVES 15%
over 12-year period

The Canadian fertilizer sector is a world leader in reducing GHG emissions produced per unit of fertilizer output.

Fertilizer Sector – NAICS 325313

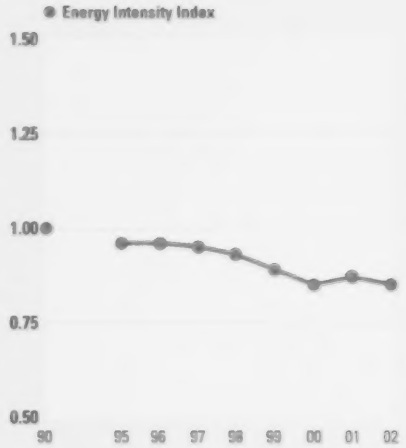
Energy Intensity and Physical Output (1990–2002)



Data source: Canadian Fertilizer Institute (CFI), February 2004.

Fertilizer Sector – NAICS 325313

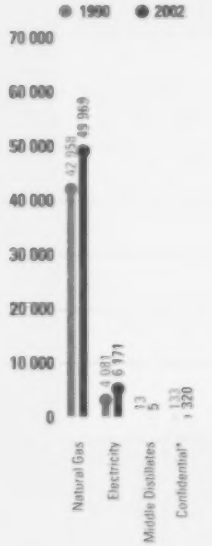
Energy Intensity Index (1990–2002)
Base Year 1990 = 1.00



Data source: Canadian Fertilizer Institute (CFI), February 2004.

Fertilizer Sector – NAICS 325313

Energy Sources in Terajoules per Year (TJ/yr.)



Data sources:
(1) Natural gas: 1990–2002, Canadian Fertilizer Institute (CFI), February 2004.
(2) Other fuels: 1990–2002, Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004. Simon Fraser University.
* Includes heavy fuel oil, liquid petroleum gas (propane) and steam.

Profile Canada's fertilizer industry is one of the world's major producers and exporters of nitrogen, potash and sulphur fertilizers, manufacturing 12 percent of the world's total fertilizer materials. Companies in this sector operate more than 20 production facilities and are among the world's most energy-efficient producers.

Actions

In recent years, Canada's fertilizer industry has undertaken a number of energy efficiency research projects. In 2002, the Canadian Fertilizer Institute (CFI), in partnership with NRCan, began a benchmarking study of all Canadian potash production facilities. In addition to collecting energy consumption data, the study included a diagnostic session on energy management practices at each of the sites.

To find ways to increase agricultural productivity while reducing environmental impact, CFI and its member companies have concluded the funding of a three-year study of nitrous oxide emissions from fertilizer use. Results are now being analysed. In another project, CFI commissioned a study to account for GHG creation and consumption throughout the life cycle of fertilizer production and use.

Individual companies were also active contributors to the sector's energy efficiency efforts. For example, Simplot Canada Limited replaced the refractory in the ammonia plant's primary reformer at its manufacturing complex in Brandon, Manitoba. The company also introduced system redundancies to reduce the number of energy-intensive unscheduled shutdowns. Simplot is now examining the feasibility of redesigning and replacing its ammonia plant's heat wheel.

Potash Corporation of Saskatchewan (PCS) refitted its product dryers to enhance heat recovery at its facility in Allan, Saskatchewan. The project reduced natural gas consumption from 2.15 GJ to 1.90 GJ per tonne of product processed. The company saved 6 percent of the natural gas used in its steam plant operations by controlled tuning of the excess oxygen in water tube boilers. PCS also completed the second phase of a cyclowash project, resulting in estimated savings of 1.44 kilowatts per tonne of product.

IMC Potash undertook a number of energy efficiency assessments at its Saskatchewan mine sites in Colonsay, Belle Plaine and Esterhazy under the company's continuous improvement program, including participation in the sector-wide potash benchmarking study. The company conducted two of these assessments in partnership with NRCan. Although the company has focused primarily on reducing natural gas consumption, it plans to target other energy sources in 2004.

Although ammonia production increased by 11 percent between 1990 and 2002, CF Industries Inc.'s ammonia production operation in Medicine Hat, Alberta, improved its fuel intensity by 14 percent. Similarly, the company reduced the energy intensity of its urea production operations at the same location by 16 percent, with a corresponding 14 percent increase in production. Energy intensity improvements resulted from a number of efficiency initiatives, including adding more sieves, reversing the ammonia synthesis loop, introducing more efficient ammonia converter intervals, installing parallel low-temperature shift converters, and completing other improvements to reduce bottlenecking and energy use, particularly in the low-pressure recovery and recycle part of CF Industries' urea plant.

Achievements

According to the Canadian Industrial Energy End-Use Data and Analysis Centre's (CIEEDAC's) and CFI's production statistics, nitrogen fertilizer production (gross) increased from 6.8 million tonnes in 1990 to 9.6 million tonnes in 2002. Natural gas consumed as fuel – and other fuel sources used for this production – totalled 56 465 TJ in 2002, versus 47 185 TJ in 1990. This represents an improvement in fuel energy efficiency of approximately 15 percent over the 12-year period.

Since 1990, potash production has increased 19 percent, totalling 13 640 000 tonnes in 2002. Overall, energy indicators show an improvement in energy intensity averaging more than 1 percent per year since 1990.

The Canadian fertilizer sector ranks among the lowest GHG emitters per unit of fertilizer output in the world. However, the manufacture of fertilizer requires significant natural gas and other inputs for both feedstock and energy, thereby generating GHG emissions, primarily CO_2. Fertilizer use also results in some GHG emissions. On the other hand, the fertilizer industry plays an important role in carbon sequestration; i.e., fixing CO_2 in agricultural soils. Carbon sequestration in "agricultural sinks" offsets the environmental impact of energy consumption during the manufacturing process. In the short term, agricultural sinks could play a key role in reducing Canada's net CO_2 emissions.

Challenges

Canada's GHG reduction goals have special significance to the fertilizer industry, a major energy consumer. In fact, despite the Canadian industry's international energy efficiency leadership, manufacturers could be at considerable risk if inflexible climate change policies are introduced. Rapid growth in worldwide demand for food is pushing total manufacturing energy consumption upward in spite of the industry's best reduction efforts. Current and projected energy efficiencies cannot offset the impact of this increasing demand.

CFI believes that major reductions in the GHG impact of fertilizers can come from improvements in their use. The fertilizer industry supports research and other efforts that help to foster best-practices approaches within Canada's agricultural industry and improve the efficiency of fertilizer use. The sector believes that the right mix of policies, practices and economic incentives could have a substantial impact on global efforts to reduce GHG emissions. Conversely, focusing narrowly on the energy used by individual industries could inadvertently increase global GHG emissions and exacerbate the world's food shortages.

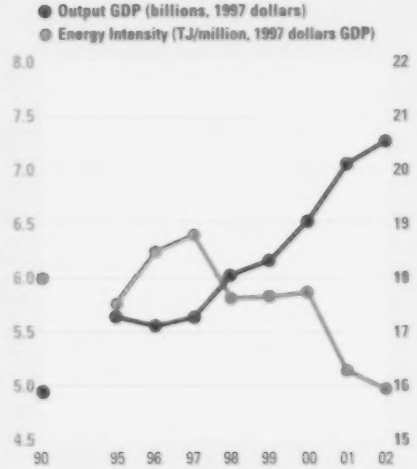
FOOD AND BEVERAGE

Sector seeks reduction in energy use of 2.2% PER YEAR through 2005

Canada's food and beverage processors improved their collective energy intensity by 17.0 percent between 1990 and 2002, and the sector anticipates an energy intensity reduction of 2.2 percent annually between 2000 and 2005.

Food and Beverage Sector – NAICS 311000, 312100[1]

Energy Intensity and Economic Output (1990–2002)

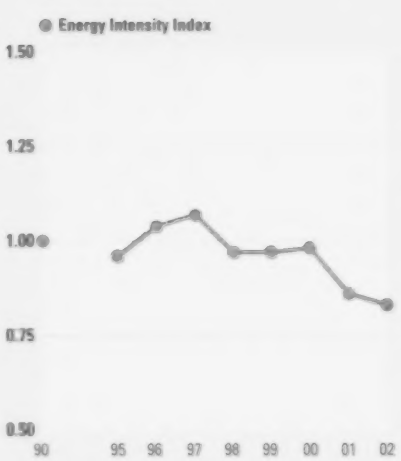


Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

[1] NAICS 311000: Food manufacturing
NAICS 312100: Beverage and tobacco product manufacturing

Food and Beverage Sector – NAICS 311000, 312100[1]

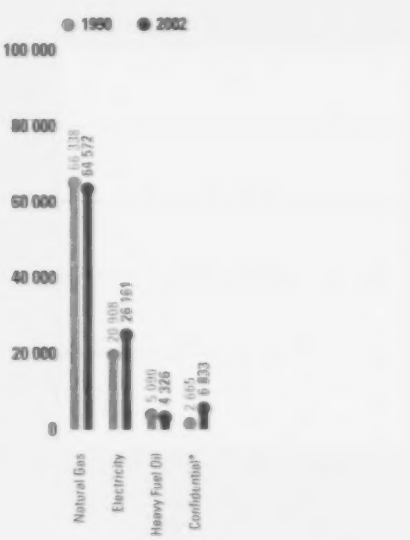
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Food and Beverage Sector – NAICS 311000, 312100[1]

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

* Includes light fuel oil (middle distillates), liquified petroleum gas/propane, steam and wood.

Profile Canada's food and beverage sector includes manufacturers that produce a diverse range of products, including meat, poultry, fish, fruit and vegetables, flour and bakery products, oils and sugars, coffee, snack foods, soft drinks and confections.

Actions

In 2002, the Food and Beverage Sector Task Force met four times, with meetings hosted in Guelph, Ontario, by the Ontario Ministry of Agriculture and Food, a CIPEC partner since 1999. Other partners include the Canadian Meat Council, the Baking Association of Canada, the Canadian Council of Grocery Distributors and the Ontario Agri Business Association.

Individual food and beverage sector companies continue to take action to improve energy efficiency and minimize GHG emissions. For example, Schneider Foods conducted energy audits that focused on natural gas and electricity at six of its Ontario facilities with the help of NRCan's Industrial Energy Audit Incentive. The audits identified 10 significant energy efficiency opportunities that, when acted on, will reduce the company's natural gas consumption by 20 percent, decrease electricity consumption by 15 percent and cut GHG emissions by an estimated 8900 tonnes per year.

To reduce operating costs, Casco Inc. of Etobicoke, Ontario, focused on improving process operations and heating, drying and compressed-air systems – areas that are heavy energy consumers. Casco made improvements to its boiler plant system, process furnaces, dryers, kilns, compressed-air systems, water systems, motor drive systems and production process systems. These initiatives enabled the company to reduce energy used per unit of output by 6 percent per year.

Maple Leaf Foods Inc. is actively exploring ways to improve energy management at the company's 85 Canadian plants. At the end of 2003, it completed energy audits at 11 facilities using Maple Leaf's Six Sigma methodology. The company currently operates a biodiesel pilot plant that has a capacity of 4 million litres per year, and it is considering the feasibility of building a commercial biodiesel plant in Montréal, Quebec. In 2003, the company reduced the overall energy it used per kilogram of production by approximately 3.5 percent.

Concerns about energy efficiency at Oxford Frozen Foods Limited of Oxford, Nova Scotia, has led the world's largest blueberry producer to add roof insulation, install high-pressure sodium lighting and refit truck bays with heat-saving vertical dock levellers. The company also converted to screw compressors and thermal siphon oil cooling, and it has recently installed a Hench refrigeration control system that is expected to cut the company's annual energy bill by 15 percent.

The Fisheries Council of Canada has launched an energy benchmarking study of nine seafood processing plants in Atlantic Canada. The study, which includes five fish processors in Nova Scotia and four lobster processing plants in Prince Edward Island, will be completed in spring 2004.

Achievements

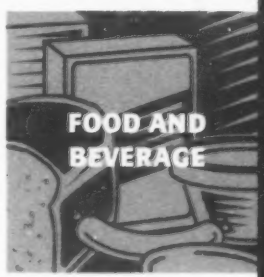
Canada's food processing industry continued to increase its gross output in 2002, but its energy use actually declined in 2002 compared with the previous year. The sector's total energy consumption fell to 101 892 TJ in 2002 compared with 103 253 TJ in 2001 – a decrease of 1.3 percent. Over the past 12 years, the sector's total energy consumption increased by 7.3 percent, from 95 003 TJ in 1990 to 101 892 TJ in 2002, due largely to a significant increase in electricity consumption.

Energy consumption is down in the sector, and the food industry has made long-term progress toward better energy efficiency. From 1990 to 2002, food processors improved their collective energy intensity by 17 percent.

Challenges

Consumer demand for more energy intensive "ready to heat and eat" meals and other products has created a substantial challenge for food processors seeking to reduce their reliance on energy. To accommodate consumer demand while continuing its march toward greater energy efficiency, the industry must seek out and adopt new technologies and embrace operational changes that minimize the energy required per unit of production.

Despite the challenges it faces, the sector anticipates an average reduction in its energy use of 2.2 percent per year between 2000 and 2005. From 2006 to 2010, the sector's goal is an average reduction in its energy use of 1.7 percent per year, for a total of 19.5 percent over the next 10 years.



FOUNDRY

Foundries focus on
ENERGY COST REDUCTION

Canada's foundries have eliminated GHG-generating fuels such as coal, oil and coke from their operations.

The sector is currently working with NRCan's Office of Energy Efficiency to develop indices and figures.

Profile Metal castings are the first step in the value-added manufacturing chain and are utilized in the manufacture of most durable goods. Markets and industries served by foundries include the automotive sector, construction, agriculture, forestry, mining, pulp and paper, heavy industrial machinery and equipment, aircraft and aerospace, plumbing, soil pipe, municipal road castings, defence, railway, petroleum and petrochemical, electricity distribution and a myriad of specialty markets. There are approximately 145 foundries in Canada, employing 13 000 people and generating annual sales of approximately $2 billion. About 80 percent of the foundry sector's production is exported.

Actions

Energy efficiency improvement is critical for Canada's foundries. At the sector level, the Canadian Foundry Association (CFA) continues to promote energy efficiency programs. In partnership with NRCan's Office of Energy Efficiency, CFA published *Guide to Energy Efficiency Opportunities in Canadian Foundries*, developed Dollars to $ense workshops designed specifically for the sector and instituted an on-site energy audit program. The audit process identifies and enables implementation of improvement projects for energy, water, wastewater, GHG and air emissions, and solid wastes to realize cost savings and tangible environmental benefits.

Foundry benchmarking data is now available thanks to the establishment of a tracking and reporting system for energy and production data that is based on Statistics Canada protocols.

TDS Dixon Inc. gave a presentation at a CFA meeting entitled "Tactics for Energy Cost Reduction" that highlighted controlling electrical demand profiles to minimize cost per kilowatt hour, targeting incremental reductions in consumption through simple operational changes, developing an energy consumption inventory to identify hidden energy-consuming equipment, measuring and adjusting gas combustion efficiency, taking control of exhaust and make-up air volumes and heating, monitoring electrical energy consumption versus production levels, and using employee awareness to eliminate energy waste.

Individual foundries have also acted on their commitment to energy efficiency. For example, Ancast Industries Ltd. of Winnipeg, Manitoba, altered furnace piping to facilitate the installation of heat recovery systems. The company continues to work with Manitoba Hydro and Ancast's engineering consultants to specify and install a new demand controller, scheduled for installation in summer 2004.

Bibby Ste-Croix of Sainte-Croix, Quebec, has switched coreless furnace melting operations to the weekend, thereby reducing peak demand for electricity and raising its utilization factor. The company has reduced demand from 800 to 600 kW and improved its utilization factor from 37 to 56 percent. In November, Bibby Ste-Croix held an in-plant energy efficiency workshop that raised staff awareness of energy savings available by taking simple daily actions.

Hydro-Québec has launched an efficiency program by paying 50 percent of the cost of a plant energy-balance study and agreeing to subsidize projects that reduce energy consumption. A successful pilot project to use energy-saving fans instead of compressed air to facilitate air combustion of shell cores was completed in 2003.

Gamma Foundries Limited of Richmond Hill, Ontario, has replaced two gas preheating stations with updated technology that is expected to save the company $50,000 per year. Gamma has also undertaken a major energy initiative by replacing inefficient lighting with more efficient alternatives, installing auto sensors and ensuring that unneeded lights are turned off. The company now captures hot air from the building's compressors and uses it for heat, and it has converted two water heaters to energy-saving, instantaneous water-heating systems.

Grenville Castings Limited of Smiths Falls, Perth and Merrickville, Ontario, has established an energy efficiency improvement plan that includes a strong executive commitment, an energy management team and champion, and employee training to instil energy-efficient behaviour in its operations. In total, Grenville Castings' energy efficiency projects in 2003 have led to an 18 percent improvement in energy cost per pound produced compared with 2002. The company plans further consumption reductions per pound of output of between 1 and 5 percent in 2004.

Achievements

Canada's foundries no longer use GHG-generating fuels such as coal, oil or coke in their operations, and they have eliminated the use of steam produced by coal-generated electricity. Escalating oil, natural gas and power costs as well as a rising Canadian dollar are motivating companies to undertake energy efficiency activities such as installing more efficient equipment, adopting better production methods, fuel switching and establishing waste-energy capture programs.

Challenges

Driven by several competitive issues in the global marketplace, Canada's foundries are continually searching for energy-efficient equipment and methods. Many foundries now go far beyond raw castings to design parts; build tooling; cast prototypes; make, machine and assemble castings; and produce completed components or assemblies ready for a customer's assembly line. This has added to the sector's capabilities, employment and profit, but it has also led to increased energy consumption. Customer demand for expanded services often conflicts with the need to remain price-competitive and to meet environmental standards. These forces are driving foundries to find cost-effective and energy-efficient technologies and solutions.

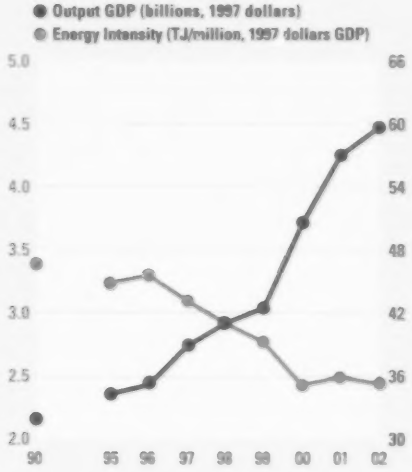
GENERAL MANUFACTURING

Three task forces lead NATIONAL EFFORT toward improved energy efficiency

Growing regional task forces across Canada continue to extend CIPEC's reach to industrial and energy organizations nationwide.

General Manufacturing Sector[1]

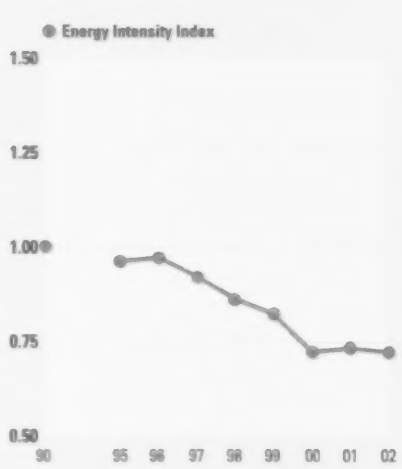
Energy Intensity and Economic Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004, Simon Fraser University.

General Manufacturing Sector[1]

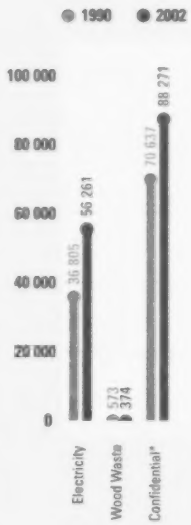
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004, Simon Fraser University.

General Manufacturing Sector[1]

Energy Sources in Terajoules per year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004, Simon Fraser University.

* Includes natural gas, heavy fuel oil, liquified petroleum gas/propane, middle distillates and steam.

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[1] NAICS 315 Clothing and Manufacturing
NAICS 316 Leather and Allied Products
NAICS 323 Printing and Related Support Activities
NAICS 3254 Pharmaceutical and Medicine
NAICS 3255 Paint Coating and Adhesive Manufacturing
NAICS 3256 Soap, Cleaning Compound and Toilet Preparation
NAICS 3259 Other Chemical Products Manufacturing
NAICS 3261 Plastic Products Manufacturing
NAICS 327210 Glass and Glass Products Manufacturing
NAICS 332 Fabricated Metal Products
NAICS 333 Machinery
NAICS 337 Furniture and Related Products
NAICS 339 Miscellaneous Manufacturing

Profile The general manufacturing sector comprises a variety of industries, including leather, clothing, furniture, printing activities, construction materials, floor coverings, insulation, glass and glass products, adhesives, plastics and pharmaceuticals. The sector encompasses approximately 2000 small, medium and large companies that, combined, consumed 144 906 TJ of energy in 2002.

Actions

The general manufacturing sector's three regional task forces continue to be active advocates of energy efficiency. Under their auspices, and with their support, individual sector members are making valuable contributions to energy efficiency. For example, Armstrong World Industries Canada Inc., a subsidiary of Armstrong World Industries Inc., has reduced its energy consumption between 1990 and 2002 by an impressive 31 percent, despite a 271 percent increase in production. This achievement earned Armstrong the 2003 ÉcoGESte award for small and medium-sized companies.

EMCO Building Products Corp. has installed a direct contact heat recovery system on the first-stage pulp refiners at its plant in Pont-Rouge, Quebec. The system, which recovers heat from waste steam into white water, recovers an average of 5.5 million Btu per hour. Staff at EMCO's plant in Edmonton, Alberta, cut power requirements by reconfiguring the paper mill process to eliminate more than a quarter of the mill's equipment. Additional improvements to burners, insulation and process water systems also enhanced energy efficiency at the plant.

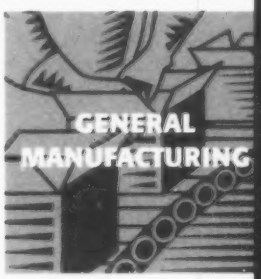
PowerComm Inc., based in Edmonton, expects to reduce GHG emissions in 2003 by 5 percent by reducing energy losses in its building envelope; introducing improvements to its electrical, HVAC and compressed-air systems; and by replacing decommissioned fleet vehicles with more fuel-efficient models.

Husky Injection Molding Systems Ltd. of Bolton, Ontario, is committed to an aggressive energy efficiency agenda. Husky continually upgrades its buildings, systems and equipment to keep pace with advances in energy technology. The company has also improved the efficiency of its vehicle fleet and installed a video-conferencing centre to reduce air travel. In 2002 alone, these activities reduced Husky's direct emissions by 1910 tonnes of CO_2e, cut indirect emissions from importing electricity by 3150 tonnes of CO_2e, and decreased other indirect emissions by 8269 tonnes of CO_2e.

Coyle & Greer Awards Canada Ltd. of Mossley, Ontario, is covering and insulating windows on the 100-m² south wall of its facility and evaluating the installation of a reflective coating on its 2500-m² roof – all to save energy. The company is also investigating the installation of wind-driven electrical generators to fill its own power needs and those of its neighbours.

The Six Sigma program at Owens Corning Canada Inc.'s Scarborough plant in Toronto, Ontario, has enabled the plant to identify and realize energy savings. The plant lowered the operating pressure in its compressed-air system, removed compressed-air service from areas of the plant where it wasn't required, and improved compressor automation. The net effect of these changes was to reduce the plant's air consumption by an amount large enough to allow the shutdown of a 750-hp compressor.

Interface Flooring Systems (Canada) Ltd. of Belleville, Ontario, has made sustainability its core corporate value. Acting on this commitment has produced amazing results. Since 1993, the company has reduced its annual landfill use from 474 tonnes to a minuscule 20 tonnes. Its water consumption has been slashed by 90 percent, and while production increased two and a half times, the company still managed to reduce its electricity and natural gas consumption by 70 percent. Interface also encourages its staff to be environmental contributors. The company promotes car pooling and bicycling and pays the cost of home energy audits for its employees. This sustainability commitment under the banner of eliminating waste has saved Interface a total of $12 million in seven years.



Achievements

The eastern, central and western General Manufacturing Task Forces continue to make progress in meeting the commitments outlined in their action plan. The task forces take an inclusive approach to energy efficiency, establishing and maintaining collaborative relationships with manufacturing, technology and energy organizations – both inside and outside the sector – that are interested in furthering industrial energy efficiency. Moreover, the growing regional task forces across Canada continue to extend CIPEC's reach to industrial and energy organizations nationwide. From coast to coast, the sector cultivates the involvement of other associations and firms and encourages its Industrial Energy Innovators to report on their energy efficiency progress.

Challenges

The general manufacturing industry is a truly national sector, with existing and prospective participants operating in every region in Canada. CIPEC's challenge is to extend its network of participation to all corners of Canada, making energy efficiency programs, resources and ideas accessible to manufacturers wherever they operate. The sector is most eager to attract participation from small and medium-sized enterprises, which make up the bulk of companies in Canada's general manufacturing industries.

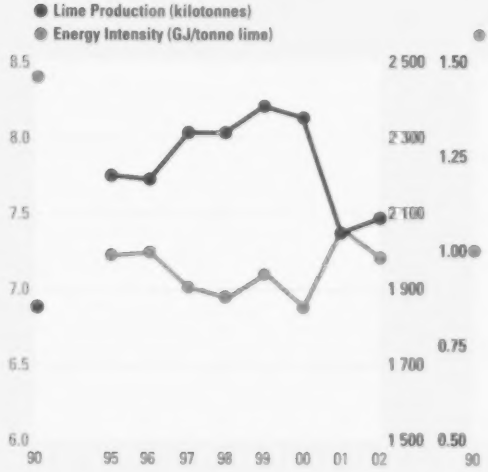
When it comes to investing in energy efficiency, companies of all sizes face a common problem: developing a compelling business case for the required expenditures. Return on energy efficiency investments are often two to three years, while economic realities compel companies to seek payback periods of 18 months or less. The sector must continue to develop innovative ways to bring return periods in line with their business requirements.

Companies use customized ENERGY WORKSHOPS to boost energy efficiency

Between 1990 and 2002, the lime sector cut its total energy consumption by 487 TJ and improved its energy intensity by 14.2 percent.

Lime Sector – NAICS 327410

Energy Intensity and Physical Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

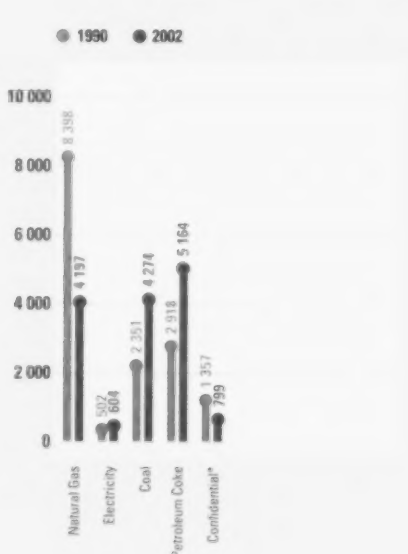
Lime Sector – NAICS 327410

Energy Intensity Index (1990–2002) Base Year 1990 = 1.00

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Lime Sector – NAICS 327410

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

* Includes heavy fuel oil, light fuel oil (middle distillates), liquified petroleum gas (propane) and coke.

Profile Canada's merchant lime sector supplies essential raw materials for the steel and mining industry, the pulp and paper industry, water treatment, environmental management and other basic industries. Operating 12 facilities and employing over 650 people, the sector's four companies had a combined lime-calcining capacity of approximately 3 million tonnes in 2002. From 1990 to 2002, the sector increased lime production by 12.8 percent to 2 085 000 tonnes.

Actions

The Canadian Lime Institute continued to promote energy efficiency within the sector throughout 2003. Chemical Lime Company of Canada Inc. held a customized energy efficiency workshop in January 2003 at its facility in Langley, British Columbia, attracting 29 participants. Graymont Western Canada Inc. held a similar workshop in November 2003 at its facility in Exshaw, Alberta. This workshop attracted 15 participants from three Graymont facilities. Carmeuse Lime (Canada) Ltd. has also developed a customized energy efficiency workshop, which was delivered in early 2004 at its Beachville operation in Ingersoll, Ontario.

There were few physical plant changes in the merchant lime sector in 2002. Energy efficiency improvement activities were primarily associated with process improvements and reductions in electricity use.

Achievements

Companies in the merchant lime sector represented by the Canadian Lime Institute continue to work actively to improve the energy efficiency of their operations. Within the sector, Industrial Energy Innovators account for close to 99 percent of Canada's merchant lime production.

According to energy data available in 2002, it took 15 039 TJ of energy to produce 2085 kilotonnes of lime. This compares with 15 158 TJ and 2047 kilotonnes in 2001 and 15 526 TJ and 1848 kilotonnes in 1990. Total energy consumption decreased by 487 TJ between 1990 and 2002, and energy intensity decreased by 14.2 percent.

Only about 40 percent of the GHGs emitted by the lime sector relate to the consumption of energy to prepare limestone for calcination and to convert it into finished lime products. The remaining 60 percent emerges from the calcination or decomposition of the limestone. GHG emissions resulting from the production of lime are offset to some extent by the reabsorption of CO_2 by lime during its life cycle. The National Lime Association estimates that approximately 25 percent of lime produced in Canada and the United States reabsorbs CO_2.

Challenges

The production of lime occurs at very high temperatures (more than 1200°C), which requires combustion fuels as the main energy source. Petroleum coke and coal are now the principal fuel sources employed to make lime, with natural gas making up most of the balance.

The industry's heavy dependence on fuel makes energy efficiency a top priority and a major challenge. Although incremental improvements continue to be made to existing manufacturing equipment, large-scale gains require substantial capital investments in new, more efficient kiln installations. Unfortunately, excess capacity and low capital turnover within the industry limit the ability of lime manufacturers to make such investments.

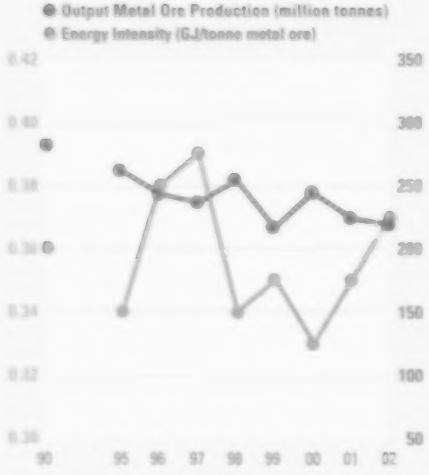
In addition, although they provide energy intensity advantages, fuel switching and the use of high-efficiency kiln technology are not always compatible with the need to produce the product quality levels required by some of the sector's largest customers.

Information sharing a KEY ELEMENT in miners' energy strategy

VCR Inc. has awarded Gold Level Champion reporting status to five Mining Association of Canada member companies and Silver Level Champion reporting status to three others.

Metal Ore Mining Sector – NAICS 212200

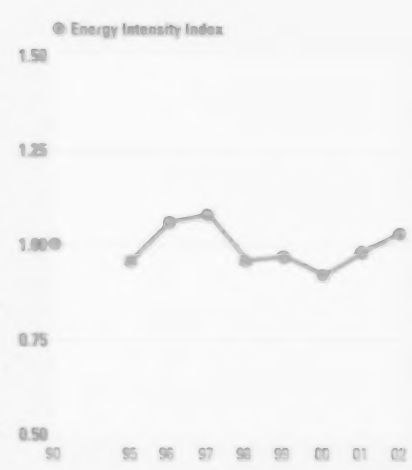
Energy Intensity and Physical Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University.

Metal Ore Mining Sector – NAICS 212200

Energy Intensity Index (1990–2002)
Base Year 1990 = 1.00



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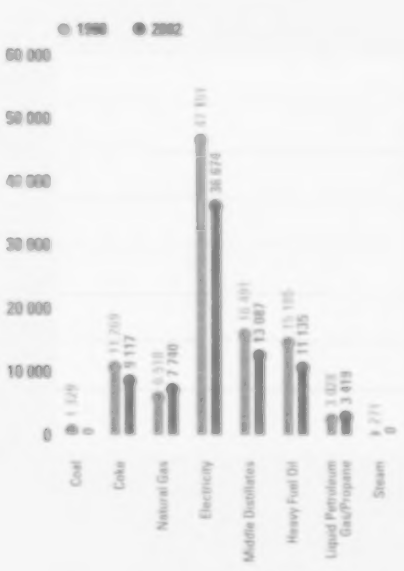
Metal Ore Mining Sector – NAICS 212200

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University.

Profile Canada's minerals and metals industry produces 60 different mineral commodities. In January 2003, there were 57 metal mines and 27 non-ferrous metal smelters and refineries (excluding aluminum) across Canada. The mining and minerals processing industry directly employs 361 000 Canadians (one in every 43 jobs), making it a major contributor to the Canadian economy. The industry contributed $36 billion to Canada's GDP in 2002 – 3.7 percent of the national total. Canada is one of the world's largest mineral exporters, with 80 percent of its production – valued at $50 billion – destined for foreign markets. This represents 13.5 percent of total domestic exports, or one in every eight export dollars. Despite an overall decline in mineral prices in recent years, mineral and metal exports increased by 71 percent between 1993 and 2002.

Actions

The mining sector is represented in CIPEC by the Mining Association of Canada (MAC). MAC actively facilitates regular energy efficiency information sharing within the Canadian mining industry and is developing industry-specific programs to promote more effective energy management. In 2003, the reach of MAC's energy efficiency and GHG-emissions-reduction programs expanded within the sector. An increasing number of mining companies participated in MAC's annual *Environmental Progress Report*, and interest in using MAC's electronic template to inventory, measure and report on energy and GHG emissions continued to grow.

During 2003, the sector developed energy and GHG management indicators, including operational energy and GHG emissions intensity indicators. The sector task force released studies on underground and open-pit energy benchmarking and a cost-curve analysis of technological reduction of GHG emissions. The task force is encouraged by strong advances in the acceptance and application of the principles and practices presented in MAC's new *Strategic Planning and Action on Climate Change: A Guide for Canadian Mining Companies*.

Communication and leadership are two of the key components of the sector's efforts to improve energy efficiency. The mining industry introduced a new energy champion – Ron Aelick, Inco Limited President, Canada and UK Operations – who will help spearhead ongoing efforts to improve the sector's energy performance. To keep energy efficiency top-of-mind among sector companies, MAC actively promoted energy management at the Canadian Institute of Mining, Metallurgy and Petroleum's annual general meeting and in an article in *CIM Bulletin*. MAC is also organizing its third energy management workshop.

Energy efficiency is also a critical concern to individual mining companies. For example, Noranda Inc./Falconbridge Limited and Iron Ore Company of Canada completed comprehensive energy audits in 2003, a process that has provided them with vital information upon which to keep their energy efficiency activities going forward.

Newmont Canada Limited continues to employ energy-saving techniques at its Golden Giant Mine in Marathon, Ontario. The company uses programmable logic controls to automatically shut down underground fans in areas that are not being used, and it has installed automatic controls on propane burners and variable speed drives on main ventilation fans to optimize energy use.

At the end of 2003, BHP Billiton Diamonds Inc. completed a one-year wind power feasibility study at its Ekati Diamond Mine™ in the Northwest Territories. The study used a 30-metre tower to collect data on wind speed and direction. Should the study show that wind power is feasible at the site, the company will investigate its use to supplement diesel generators and to provide a large portion of power at future satellite camps.

In 2002, the Energy Breakthrough program at Inco Limited yielded emissions reductions of over 32 kilotonnes of CO_2e and energy savings of 548 TJ, saving the company $17 million. Compared with its 1990 baseline, Inco has improved its energy index by 9 percent and its absolute emissions by 4.7 percent, despite an increase in the company's on-site production over the same period.

Achievements

The Canadian metal mining and non-ferrous smelting and refining industry's GHG emissions are linked to energy consumed during the production process. In 2001 (the most recent year for which data is available), about 6.9 percent of the industrial energy used in Canada was consumed by metal mining (3.2 percent) and non-ferrous metal smelting and refining (3.7 percent). Also in 2001, some 5.6 percent of Canada's industrial GHG emissions originated from metal mining (2.9 percent) and non-ferrous metal smelting and refining (2.6 percent). That amount represents 1.5 percent of Canada's total GHG inventory and 0.81 percent of Canada's direct GHG emissions.

As part of their commitment to GHG reduction, 16 of MAC's 26 members – representing most of the energy consumed in the mining sector – are participating in Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.). To date, VCR Inc. has awarded Gold Level Champion reporting status to five MAC member companies and Silver Level Champion status to three others. MAC itself is a three-time Gold Level Champion Reporter and a 2001 recipient of the VCR Inc. Leadership Award.

Challenges

The sector's principal challenge is to reduce GHG emissions without compromising production and growth. Barriers to further emissions reductions include the limited use of metering within mining operations, the current limits of technology, and the net cost of reducing CO_2 emissions further. As a price taker, increased production costs create a competitive disadvantage.

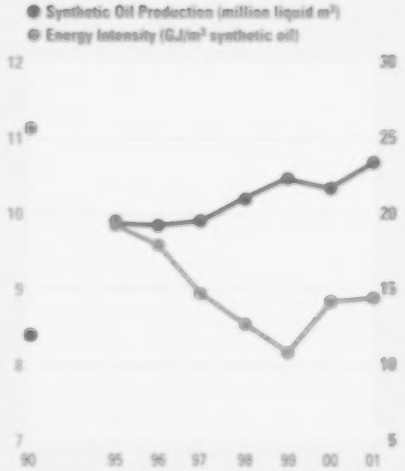
The keys to the industry's progress are innovation and dedication. New technology and results-based energy audits are enabling the mining sector to boost its energy efficiency, reduce emissions and become more internationally competitive. As energy prices rise, companies are finding many financially attractive opportunities to improve efficiency and reduce costs while substantially cutting GHG emissions per unit of output. Despite uncertain markets and fluctuating mineral and metal prices, the mining sector is committed to making substantial energy efficiency gains over the coming years.

Companies boost yields by RECOVERING WASTE HEAT and improving process efficiency

The sector's total annual production has climbed 95 percent since 1990, yet its energy use rose by only 56 percent. This has led to an energy intensity improvement of 20 percent.

Oil Sands Sector – NAICS 211114

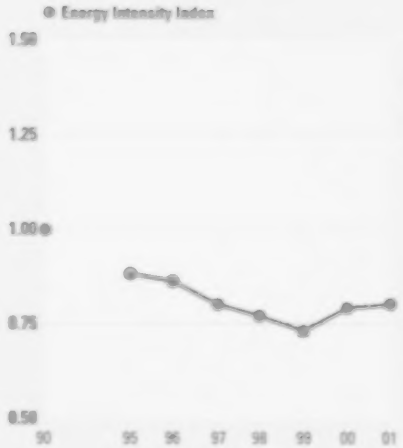
Energy Intensity and Physical Output (1990–2001)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004, Simon Fraser University.

Oil Sands Sector – NAICS 211114

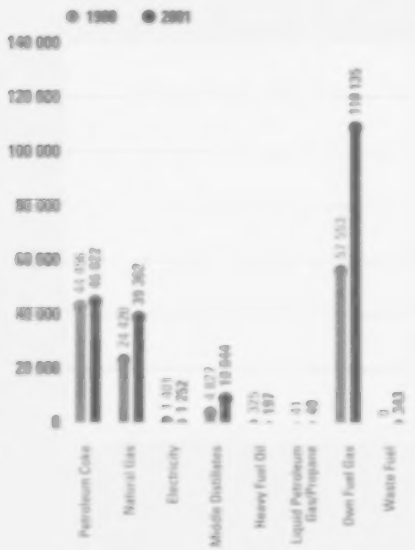
Energy Intensity Index (1990, 1995–2001)
Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004, Simon Fraser University.

Oil Sands Sector – NAICS 211114

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004, Simon Fraser University.

Profile Canada's oil sands sector includes several plants in northern Alberta and one heavy oil upgrader in Saskatchewan. Together, these facilities produce more than 400 000 barrels of crude oil per day for markets in Canada and the United States. The sector is a major employer and a significant contributor to Canada's GDP.

Actions

The oil sands industry's plants are improving the reliability of their operations and introducing programs to recover waste heat and boost yields through more efficient processing. The introduction of new technologies in the mining and extraction stages is also leading to significant energy efficiency gains.

In 2002, Suncor Energy Inc. – Oil Sands continued construction work on the Firebag Oil Sands Project north of Fort McMurray, Alberta. Firebag is designed to use steam-assisted gravity-drainage (SAGD) technology to reach deep bitumen deposits with less impact on the air, water and land than traditional mining methods. The first stage of Firebag is expected to raise production capacity to 260 000 barrels per day by 2005. Between 1998 and 2001, Suncor's oil sands operations improved their energy intensity by 17 percent by introducing new equipment and processes. Suncor estimates that planned energy efficiency and GHG-emissions reduction initiatives should lower its GHG emissions intensity by 41 percent in 2005 compared with the 1990 base year.

Although Syncrude Canada Ltd. plans to increase its annual crude production by 95 million barrels between 1988 and 2012, it has targeted a one-third improvement in its energy use and CO_2 emissions per barrel over that period. This represents a 25 percent reduction compared with 1990. The company plans to adopt less energy intensive mining and extraction methods, upgrade its technology and implement process improvements to reach these targets.

Staff at the Athabasca Oil Sands Project (AOSP) has been active in external education, training and consultation by presenting papers and promoting study development at numerous association, government and international events. AOSP staff has also participated in many working groups concerned with oil sands efficiency standards, environmental supply chain management, CO_2 capture and sequestration studies, life-cycle analysis, emissions allocation, domestic offset promotion and clean development in Latin America and China. AOSP is working with provincial and federal organizations to design effective GHG emissions measurement, reporting and verification methods as well as providing input on provincial and federal climate change policies. AOSP is committed to reducing its GHG emissions by 50 percent by 2010 through a combination of energy efficiency measures, purchased and partner-generated offsets, and clean development mechanism projects in conjunction with international partners.

Petro-Canada is actively working to reduce or mitigate GHG emissions generated by oil sands activities by investing in research and development to improve oil sands technology. The company's current oil sands operations are far more energy efficient than earlier projects, and further advances in efficiency are expected. Petro-Canada's oil sands development at MacKay River, near Fort McMurray, Alberta, incorporates design improvements that have reduced projected GHG emissions by approximately 15 percent. The project will use technology that enables Petro-Canada to access previously inaccessible resources and will do so with significantly less surface impact than traditional oil sands mining. A planned cogeneration steam and electricity plant at the site, expected to be in operation by 2005, will help cut energy drawn from the Alberta power grid and minimize GHG emissions. The plant is expected to save 2 779 922 GJ per year and reduce annual GHG emissions by 144 000 tonnes of CO_2e.

The Alberta Chamber of Resources released *Oil Sands Technology Roadmap: Unlocking the Potential* in January 2004. The intention of the roadmap process is to lead the implementation of an industry vision that is competitive, economical and respectful of its environmental footprint while achieving the production goal of 5 million barrels per day by 2030. The document analyses potential technology directions to address these challenging goals and will be useful for developing strategic plans, establishing research directions and setting government policy.

Achievements

The oil sands sector continued to make steady progress toward energy efficiency in 2002. Energy consumed per unit of production rose slightly to 8.89 GJ/m^3 in 2001 compared with 8.84 GJ/m^3 in 2000. Although the sector's total annual production has risen 95 percent since 1990, its energy use rose only 56 percent. In 2001, the sector's energy consumption totalled 207 335 TJ, and its energy intensity has improved by a total of 20 percent since 1990. This compares favourably with the sector's target of a 1 percent annual minimum average improvement in energy efficiency per unit of production.

Challenges

The oil sands industry is a technologically complex and capital-intensive business. To sustain their march toward improved energy efficiency, sector companies must continue to combine major investments in innovative technologies with continually improving operating systems and practices. The sector's success rests on its ability to develop and implement better, less energy intensive extraction methods and its capacity to improve material-handling systems to accommodate ever-increasing production. The massive scale of production required for oil sands means that these activities continue to tax the industry's financial capabilities and human resources. The long lead times and substantial investments required to introduce enhancements continue to force difficult choices on the industry and limit the sector's progress toward greater energy efficiency.

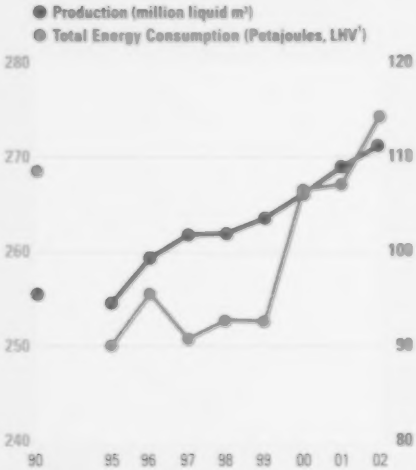
PETROLEUM PRODUCTS

Energy intensity index records
19 % IMPROVEMENT
over 12 years

In 2002, the sector's energy intensity index stood at 91.8 – 2 percent better than in 2001 and 19 percent better than in 1990.

Petroleum Products Sector – NAICS 324110

Production and Energy Consumption (1990, 1995–2002)

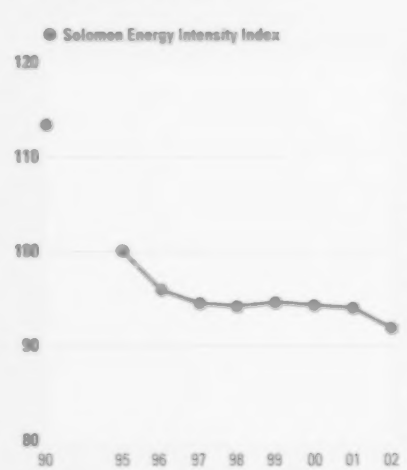


Data source: *Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990 to 2002.* Prepared for the Canadian Petroleum Products Institute (CPPI) and Canadian Industry Program for Energy Conservation by John Nyboer. Canadian Industrial Energy and End-Use Data Analysis Centre (CIEEDAC), February 2004, Simon Fraser University.

¹ LHV (lower heating value) does not include the latent heat of the water vapour (steam) generated as a result of combustion.

Petroleum Products Sector – NAICS 324110

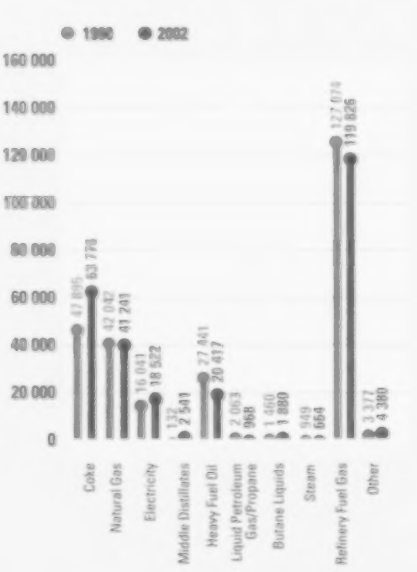
Solomon Energy Intensity Index (1990, 1995–2002) Base Year 1990 = 113



Data source: *Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990 to 2002.* Prepared for the Canadian Petroleum Products Institute (CPPI) and Canadian Industry Program for Energy Conservation by John Nyboer. Canadian Industrial Energy and End-Use Data Analysis Centre (CIEEDAC), February 2004, Simon Fraser University.

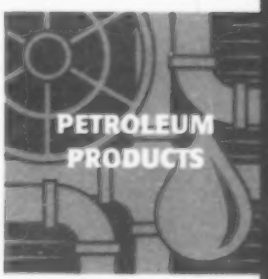
Petroleum Products Sector – NAICS 324110

Energy Sources in Terajoules per Year (TJ/yr.) (LHV)



Data source: *Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990 to 2002.* Prepared for the Canadian Petroleum Products Institute (CPPI) and Canadian Industry Program for Energy Conservation by John Nyboer. Canadian Industrial Energy and End-Use Data Analysis Centre (CIEEDAC), February 2004, Simon Fraser University.

Profile Canada's petroleum products sector markets gasoline, diesel, heating oil, jet fuels, lubricating oil, grease, food-grade white oils, asphalts and aromatic hydrocarbons through a network of more than 15 000 wholesale and retail outlets nationwide. Operating 21 oil refineries across the country, the industry provides direct employment for 100 000 Canadians and generates an estimated 100 000 jobs indirectly.



Actions

Companies in the petroleum products sector continue to take significant actions to improve their energy efficiency and reduce GHG emissions. For example, Imperial Oil Limited is participating in a worldwide initiative to develop a Global Energy Management System. Imperial Oil is phasing in the system at all its manufacturing sites, putting in place a key tool to improve energy efficiency across the company. It is also building a $120 million, 90-megawatt cogeneration facility at its manufacturing site in Sarnia, Ontario. Scheduled for completion in 2004, the facility will provide electrical power and steam. In 2002, Imperial Oil's overall downstream emissions decreased by about 1.0 percent compared with the previous year.

In 2002, Petro-Canada's downstream operations created energy intensity index scorecards, which are used as part of an energy management tracking process to ensure consistent stewardship of energy practices. The company's downstream operations also successfully completed capital projects and operational improvements, which, combined with process reliability, enabled the company to reduce its energy intensity index. An energy best-practices workshop is planned for early 2003 in which Petro-Canada and energy consultants will establish key energy-related best practices for their downstream operations. Since 1990, Petro-Canada has improved energy efficiency in its downstream operations by 23 percent and improved its energy intensity from 114.6 in 1990 to 88.2 in 2002.

Suncor Energy Products Inc.'s marketing and refining operations have set a 2005 emissions-reduction target per unit of production of 22 percent compared with 2002. With help from environmental consultants, Suncor has designed and is implementing a GHG-reduction program for its operations. During 2002, Suncor also began developing policies and guidelines to increase supplier participation in the company's sustainability vision. Suncor conducted a workshop on GHG emissions and energy efficiency with a group of key suppliers, leading several suppliers to initiate activities such as creating internal energy audit teams, hiring energy managers and setting targets for reductions in GHG emissions. In August 2002, Suncor officially opened its first car wash in Canada to use solar pool-heating technology to help heat wash water. The solar panel installation at the Ontario facility is designed to reduce the car wash's use of natural gas for water heating by 16 000 m^3 per year and reduce CO_2 emissions by 30 tonnes annually.

Shell Canada Products' business is committed to a long-term program of improving energy efficiency. In 2002, Shell's capital budget included over $12 million for energy improvement projects. At the beginning of the year, Shell Canada implemented a significant internal incentive to improve energy efficiency by including energy efficiency performance in its employee variable pay program. The company's proposed business plan for 2003 to 2007 allocates approximately $29 million to energy improvement capital projects at its three refineries. These projects are intended to reduce CO_2 emissions by over 300 000 tonnes per year.

TransCanada Corporation and Grandview Cogeneration Corporation, an affiliate of Irving Oil Limited, plan to build a 90-megawatt natural-gas-fired cogeneration power plant on the site of the Irving oil refinery in Saint John, New Brunswick. Under a 20-year tolling arrangement, Irving will provide fuel for the plant and contract for 100 percent of the plant's heat and electricity output. Capital cost of the plant is estimated at approximately $85 million.

Achievements

Since the 1990 base year, the petroleum products sector's total energy consumption has increased slightly by 2.1 percent to 274 215 TJ (LHV, or lower heating value); production over the same period increased by 16.5 percent. In 2002, the sector's energy intensity index stood at 91.8 – 2 percent better than in 2001 and 19 percent better than in 1990. The sector utilizes the Solomon Energy Intensity Index because it is an international standard that dates back to 1990, is well documented and is the basis for commitments from members of the Canadian Petroleum Products Institute.

The sector's CO_2 emissions for 2002 are only marginally above 1990 levels (1 percent, or about 186 kilotonnes) in spite of an increase in production of about 16 percent.

In 2002, production of petroleum products increased by 2.1 percent while energy consumption increased by 2.7 percent, or 7 260 TJ (LHV), compared with 2001.

Challenges

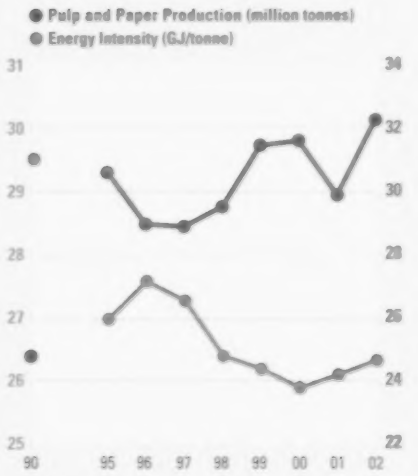
Although the sector has achieved significant performance in CO_2-equivalent emissions and energy consumption, future progress will be more difficult and more costly. Meeting mandated standards for lower sulphur content for gasoline, diesel fuel and other products will require the industry to invest highly in capital improvements. Although low-sulphur fuels have environmental advantages at the point of consumption, all low-sulphur products require more energy to produce, thereby making it more difficult and expensive for refineries to reduce their CO_2 emissions.

Sector uses
RENEWABLE ENERGY
to cut use of coal and oil

Since 1990, Canada's pulp and paper industry has cut its oil consumption by half, resulting in a 44 percent improvement in its GHG emissions intensity.

Pulp and Paper Sector – NAICS 322100

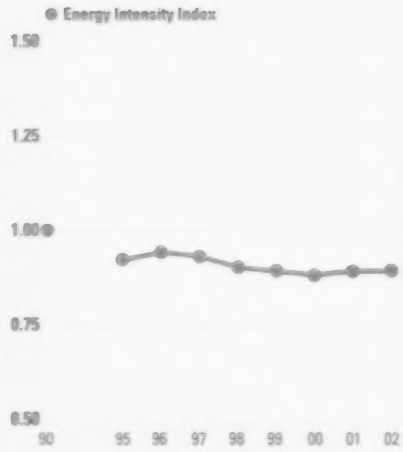
Energy Intensity and Physical Output (1990–2002)



Data source: Forest Products Association of Canada's *Energy Monitoring Report, 1990–2002.*

Pulp and Paper Sector – NAICS 322100

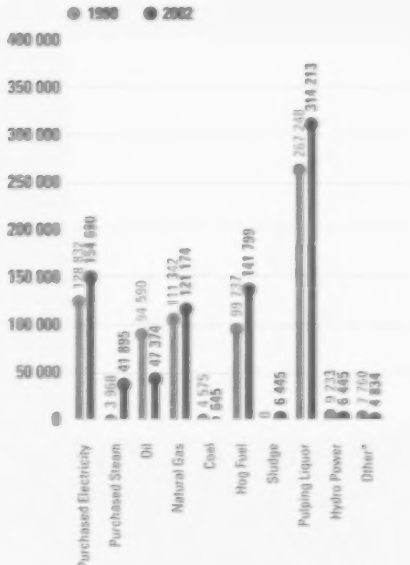
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Forest Products Association of Canada's *Energy Monitoring Report, 1990–2002.*

Pulp and Paper Sector – NAICS 322100

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Forest Products Association of Canada's *Energy Monitoring Report, 1990–2002.*

* Includes distillates, diesel, liquified petroleum gas (propane), other purchased energy and other self-generated energy.

Profile Pulp and paper, a key component of the forest products industry, is a major contributor to Canada's economy. Besides market pulp, the sector produces newsprint, specialty papers, paperboard, building board and other paper products.

Actions

The pulp and paper sector has embarked on a series of benchmarking studies, conducted by the Pulp and Paper Research Institute of Canada (Paprican) with the support of NRCan's Office of Energy Efficiency. These benchmarking studies will identify best practices and enable companies to determine where additional opportunities for improvement exist.

Individually, many sector companies have recorded notable success in energy conservation and GHG emissions reductions in recent years.

Alberta-Pacific Forest Industries Inc. (Al-Pac), located in Boyle, Alberta, takes a proactive approach to GHG emissions reduction. The company's 54-MW biomass-powered cogeneration unit, which produces enough electricity to light a city of 45 000, fills more than 80 percent of Al-Pac's energy needs. The company, which credits its green power generation program for most of its GHG reductions, won Canada's Climate Change Voluntary Challenge and Registry Inc.'s (VCR Inc.'s) 2002 Leadership Award for the forest products industry.

F.F. Soucy Inc.'s newsprint mill in Rivière-du-Loup, Quebec, won ÉcoGESte's award for large business for its achievements in reducing GHG emissions. Between 1991 and 2002, by capturing residual heat, modernizing heating equipment and undertaking a number of conservation measures, the company has improved its energy efficiency by 26 percent. Recently installed new boiler-control equipment has reduced the mill's energy intensity by 3 percent.

Papier Masson Ltée, a newsprint mill in Gatineau, Quebec, won ÉcoGESte's award for annual performance and was a finalist in the competition's category of large business. The company's 2002 heat recovery optimization project resulted in a 6 percent reduction in energy intensity. Since 1990, the mill has improved its energy efficiency by 20 percent.

The pulp and paper sector has the largest industrial cogeneration capacity in Canada, and a number of companies are successfully employing cogeneration as a way to improve energy efficiency.

- In 2003, Kruger Inc. launched Newfoundland and Labrador's first cogeneration plant at its Corner Brook mill – a $30 million biomass facility that supplies 15 MW to the provincial power grid.
- Abitibi-Consolidated Inc.'s expansion of its hydro plant in Bishop's Falls, Newfoundland, also added electricity supply to the grid.
- Canadian Forest Products Ltd. and BC Hydro will spend $81 million to install a 48-MW biomass-fired turbogenerator in Prince George, British Columbia, making two pulp and paper mills self-sufficient in terms of energy.
- NorskeCanada has proposed a $420 million, 362-MW commercial biomass cogeneration venture that would generate substantial power for Vancouver Island.
- Hydro-Québec will buy 40 MW of electricity generated by two new biomass-fired projects.

Achievements

The pulp and paper sector's energy intensity improved 11 percent from 1990 to 2002, all but meeting its commitment to a 1 percent annual improvement. Earlier efficiency gains have been slightly offset by upward structural intensity changes due to production shifts toward higher-grade papers.

Pulp and paper is Canada's leading industrial user of renewable energy, with biomass and hydro-power making up 55 percent of the sector's energy consumption. The industry's strategy of substituting biomass for fossil fuels and using less emissions-intensive natural gas in place of oil and coal are key components in the industry's success in reducing CO_2 emissions. Since 1990, the industry has cut its oil consumption in half and essentially eliminated its use of coal.

Between 1990 and 2002, Canadian pulp and paper companies reduced their GHG emissions by an aggregate 28 percent. When a 30 percent increase in production is considered, GHG emissions intensity improved 44 percent. The pulp and paper sector is the first industry to sign a Memorandum of Understanding with the Government of Canada, committing itself to an additional 15 percent reduction in GHG emissions intensity by 2012.

Challenges

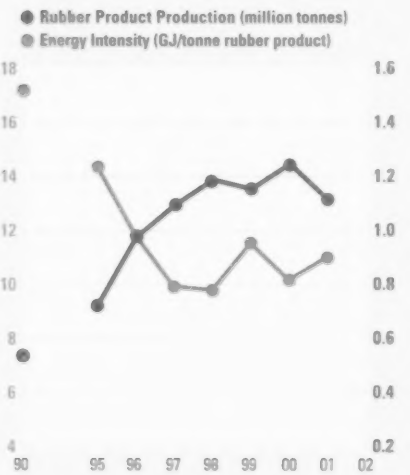
Higher natural gas costs and the unprecedented appreciation of the Canadian dollar are combining to hinder the industry's ability to make further gains in energy efficiency and GHG emissions reduction. Natural gas represents 70 percent of the sector's fossil fuel use, and rising prices increase the cost pressures on the industry, especially on mills that lack access to renewable biomass fuels. The Canadian dollar's 2003 increase of 20 percent against the U.S. dollar cost the Canadian forest products industry about $3 billion. This sum is greater than the industry's combined capital expenditures in 2002. Obviously, a higher dollar significantly squeezes the sector's capacity for investment in fuel-switching projects or equipment upgrades to enhance energy efficiency and to further reduce GHG emissions.

Tire Smart program takes ENERGY EFFICIENCY where rubber meets the road

Canada's rubber industry more than doubled its production between 1990 and 2001 while improving its energy intensity by 35 percent.

Rubber Sector – NAICS 326200

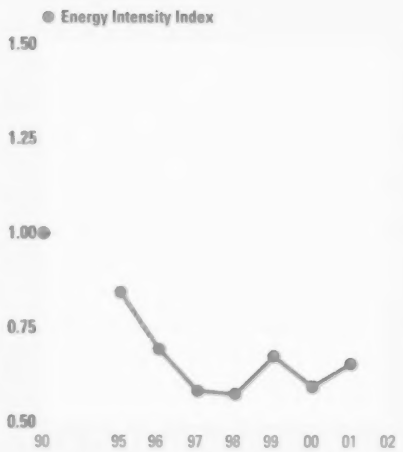
Energy Intensity and Physical Output (1990–2001)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2001.* December 20, 2002. Simon Fraser University.

Rubber Sector – NAICS 326200

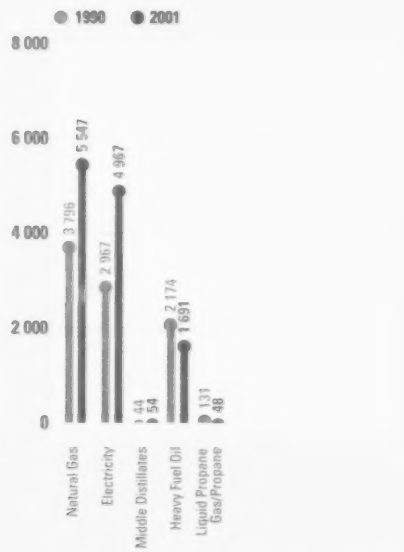
Energy Intensity Index (1990–2001) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2001.* December 20, 2002. Simon Fraser University.

Rubber Sector – NAICS 326200

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2001.* December 20, 2002. Simon Fraser University.

Profile **The rubber products sector comprises establishments that are engaged in manufacturing tires and tubes, automotive parts, rubber hoses and belting, mechanical rubber goods and a wide variety of other products, such as rubber and plastic weatherstripping, pressure-sensitive tape, rubber gloves, rubber mats, rubber household products and tire retreading materials. To meet demand for its products, the rubber products industry employs just over 26 000 people in about 240 facilities nationwide, providing a total payroll of more than $700 million annually.**

Actions

The rubber industry continues to take the initiative in improving its energy efficiency. For example, the Rubber Association of Canada (RAC) joined forces with CIPEC to produce a handbook for rubber manufacturers called *Energy Efficiency Opportunities in the Canadian Rubber Industry*. An example of the Canadian rubber manufacturing industry's commitment to reducing GHG emissions, the handbook helps manufacturers identify how they can make their facilities and processes more energy efficient. The publication is also designed to spark ideas on how to reduce energy costs and give manufacturers a starting point for energy audits of their facilities.

The first phase of the expanded Be Tire Smart – Play Your Part program, a joint project of RAC and NRCan, involved collecting information about tire inflation through a national survey. The survey, which obtained information on 1800 motorists in six locations across Canada, has revealed serious problems with Canadian motorists' knowledge and behaviour regarding tire inflation. Seventy percent of Canadian passenger cars and light trucks have at least one tire that is improperly inflated by at least 10 percent. Forty percent of vehicles have at least one tire that is 20 percent under- or over-inflated, a potentially serious problem that can lead to reduced safety, higher fuel costs and increased GHG emissions. In addition, the study found that motorists do not know where to look for the proper tire pressure ratings for their vehicle, when to measure tire pressure and what procedures to follow for proper tire maintenance. As part of its efforts to remedy these problems, RAC and NRCan have launched a Web site – www.betiresmart.ca – that offers information and tips on proper tire safety and fuel efficiency.

If all personal vehicles in the country operated with properly inflated tires, more than 640 million litres of fuel could be saved every year – enough liquid to fill 240 Olympic-sized swimming pools – and CO_2 emissions would be reduced by 1.5 million tonnes annually. If commercial fleet vehicles' tires were included, the number would be significantly higher.

Individual RAC member firms have also taken action to improve energy efficiency. For example, AirBoss Rubber Compounding has committed over $300,000 to a series of energy efficiency projects at its facility in Kitchener, Ontario. The company's plant has a rubber mixing capacity of 90 000 tonnes annually, the largest single independent capacity for custom rubber mixing on the continent. As part of its energy efficiency program, AirBoss has insulated steam boilers, steam lines and condensate return lines, installed power-factor-correction equipment, retrofitted 3000 light fixtures with new lights and ballasts, repaired compressed-air leaks and initiated a boiler efficiency program. These improvements have resulted in a relative reduction in energy used per unit of output of 8 percent per year and a reduction in GHG emissions of 50 tonnes of CO_2e per year. Payback on the investment is expected within two years.

NRI Industries Inc. of Toronto, Ontario, has spent a large amount of capital over the last few years on equipment upgrades to improve productivity. Part of this capital is being spent to reduce electricity use by installing high-efficiency motors and capacitors to increase electrical system power factors. Other improvements have been to install rapid-roll doors to conserve heat and introduce continuous curing processes. The company estimates that its use of high-efficiency equipment will reduce GHG emissions by 10 percent; installing continuous curing processes and improving building and equipment insulation will cut another 5 percent from NRI's total GHG emissions. NRI is also studying ways to reduce electricity consumption by converting injection moulding machine platens from electricity to steam.

Achievements

Preliminary data for 2002 suggests that total production of the rubber products sector was 1 159 000 tonnes, with a value of approximately $7.0 billion, up from 531 961 tonnes and $3.31 billion in 1990. Most of the Canadian industry's total shipments were exports, with more than 95 percent of these going to the United States. It is estimated that the energy consumption of Canada's rubber products industry increased from 9115 TJ in 1990 to 15 591 TJ in 2002. Because 2002 data was not finalized at the time of this report's printing, the adjoining graphs show official data only to the end of 2001. This data indicates that Canada's rubber industry more than doubled its production between 1990 and 2001 while improving its energy intensity by 35 percent.

Challenges

The rubber industry faces a number of issues that affect its efforts to improve energy efficiency, among them rising energy costs and increasing foreign competition. Rising energy prices, accelerated by international uncertainties, are putting serious pressures on manufacturers. Although higher prices provide a strong incentive to make long-term investments in energy efficiency, weak international markets and intensifying competition from producers that benefit from low labour costs make it difficult to find the needed capital.

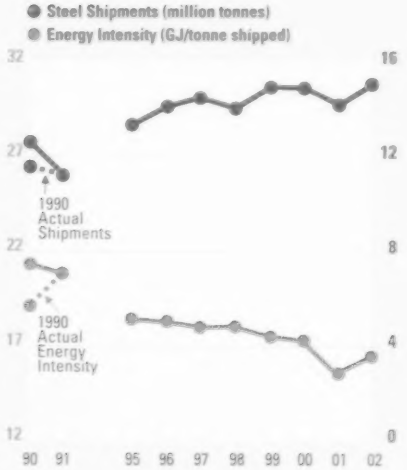
BENCHMARKING STUDY

identifies energy improvement opportunities

Through voluntary early action, the Canadian steel sector has already exceeded the Kyoto Protocol target of reducing greenhouse gas emissions to 6 percent below 1990 levels.

Steel Sector – NAICS 331100

Energy Intensity and Physical Output (1990–2002)



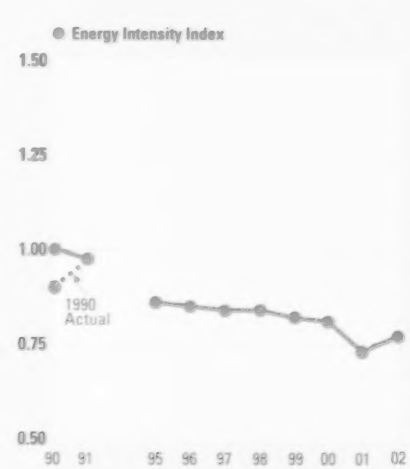
Data source: Energy: *NAICS Energy Consumption Report – Updated 1990 Data*; CIEEDAC per Statistics Canada, Cat. 57-003 XPB, November 21, 2003.

Data source: Shipments: Statistics Canada. Cat. 41-001 XIB, *Primary Iron and Steel*, Vol. 58, No. 12.

1990 adjustment: CSPA

Steel Sector – NAICS 331100

Energy Intensity Index (1990–2002) Base Year 1990 (adjusted) = 1.00



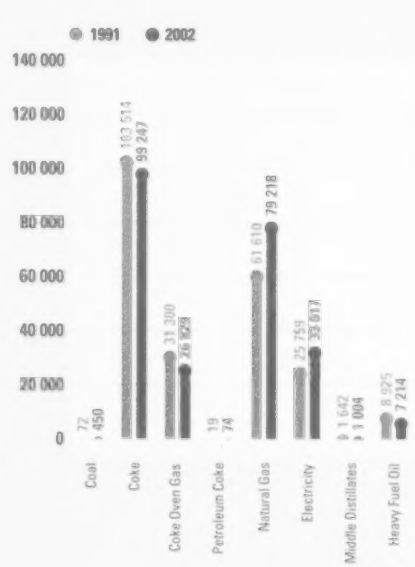
Data source: Energy: *NAICS Energy Consumption Report – Updated 1990 Data*; CIEEDAC per Statistics Canada, Cat. 57-003 XPB, November 21, 2003.

Data source: Shipments: Statistics Canada. Cat. 41-001 XIB, *Primary Iron and Steel*, Vol. 58, No. 12.

1990 adjustment: CSPA

Steel Sector – NAICS 331100

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Energy: *NAICS Energy Consumption Report – Updated 1990 Data*; CIEEDAC per Statistics Canada, Cat. 57-003 XPB, November 21, 2003.

Profile Canada's steel sector is one of the country's largest industries, generating annual sales of more than $11 billion, including more than $3 billion in exports. The companies that make up the steel sector supply flat-rolled (sheet and plate), long (re-bar and structural steel) and specialty and alloy (stainless and tool steels) products for major markets in the automotive, appliance, oil and gas, machinery, construction and packaging industries. The Canadian steel sector comprises 16 plants that directly employ 35 000 workers in five provinces.

Actions

In 2002, the Canadian Steel Producers Association (CSPA) initiated an energy benchmarking study of the Canadian steel sector with funding from NRCan's Office of Energy Efficiency. The data-gathering phase of the study, which is designed to identify opportunities for further improvements in energy efficiency, was completed in 2003, and a final report is expected in the third quarter of 2004.

Canadian steel producers are participating in a worldwide effort to discover and apply new steelmaking technologies to greatly reduce the industry's energy intensity and CO_2 emissions. Under the auspices of the International Iron and Steel Institute, regional consortia are being established, and findings will be shared. The all-encompassing three-phase program will be carried out over the next 7 to 10 years.

Individual companies are also making strides toward greater energy efficiency. For example, Algoma Steel Inc. improved its energy intensity by 10.5 percent from 1993 to the end of 2002; its CO_2 emissions were reduced by 22.5 percent over the same period. Algoma reduced its use of heavy fuel oils to zero in 2002, linked most of its facilities to a power-monitoring system, and built energy-conservation objectives and targets into its ISO 14001 Environmental Management System.

Dofasco Inc. implemented an energy-conservation program at four of its main office buildings. As part of the program, Dofasco encouraged employees to change their energy-consuming habits – it distributed energy-conservation reminder stickers to be attached to light switches and computer monitors, conducted night audits and left reminders for employees when equipment was found to be running unnecessarily, and reduced lighting in over-lit areas. The company saved an estimated $50,000 (or 2500 GJ) in electricity in the last five months of 2003.

In 2002, the Stelco Inc. group of businesses achieved a 14 percent improvement in specific energy consumption and a 16.8 percent improvement in CO_2 intensity. Stelco estimates that energy efficiency projects and offsets will further reduce its CO_2 emissions by approximately 800 000 tonnes per year over the next five years.

Individual Stelco facilities contributed significantly to the company's improvement in 2002. For example, Stelco Lake Erie reduced natural gas consumption on its blast furnace gas bleeder pilots, shut off its basic oxygen furnace ladle heater when not in use, and sealed laser and camera openings on its reheat furnace to reduce heat losses.

Stelco Hamilton rationalized its steam loads, shut down an inefficient boiler, introduced a steam trap maintenance program, and modified its sinter plant fan impeller to incorporate a new, energy-efficient design. Norambar inc. (formerly Stelco McMaster Ltée) upgraded its bar mill to reduce electrical consumption by 12.6 percent.

Stelfil Ltée installed a high-speed roll-up door in a high-traffic area, considerably reducing its natural gas heat load. Stelfil also installed more efficient equipment, including light-emitting diode lamps, transformers and rectifiers.

Achievements

The Canadian steel industry is playing an important role in addressing climate change. Through voluntary early action, the Canadian steel sector has already exceeded the Kyoto target of reducing its GHG emissions to 6 percent below 1990 levels. Since 1990, CSPA members have reduced their CO_2 emissions by 20 percent and reduced the amount of energy used to make a tonne of steel shipped by 23 percent. The sector's energy intensity performance decreased slightly, from 15.81 GJ per tonne in 2001 to 16.40 GJ in 2002.

Challenges

Canadian steelmakers will continue to build on their record of achievement. An energy benchmarking study currently underway will identify opportunities for facility initiatives to reduce energy use and contribute to further reductions in GHG emissions. There will, however, be challenges to overcome.

Ore-based processes (such as blast furnace operation, smelting and direct reduction processes) require a certain amount of carbon- and hydrogen-based reducing agents – including coal, oil, natural gas and derivatives such as coke – to reduce iron oxide to iron. This places a practical limit on the opportunity for further energy savings in efficient processes such as blast furnace operation.

The ability to invest in new processes and technologies will be key to sustaining improvements already made and to taking further steps to improve energy efficiency. The Canadian steel industry is under increased pressure because of higher raw material prices, driven primarily by the demand for scrap in the burgeoning Chinese economy. Moreover, prices for finished products are under constant pressure from offshore producers seeking access to lucrative North American markets. Some of the idled U.S. steelmaking capacity has come back on stream, in some cases with competitive advantages over existing companies. These pressures combined to place increased economic stress on a number of CSPA member companies through 2002 and 2003.

Government must acknowledge the impressive progress the industry has already made and support efforts to find new and unique solutions that limit GHG emissions if the industry is to achieve its energy efficiency goals.

Improvements in DAY-TO-DAY OPERATIONS drive company reductions in energy use

The textile industry improved its energy intensity by 44.0 percent and cut its actual energy use by 39.7 percent between 1995 and 2002.

Textiles Sector – NAICS 313, 314[1]

Energy Intensity and Economic Output (1990–2002)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

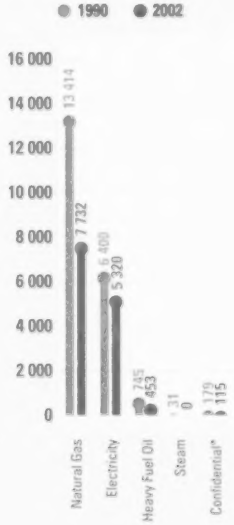
Textiles Sector – NAICS 313, 314[1]

Energy Intensity Index (1990–2002) Base Year 1990 = 1.00

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

Textiles Sector – NAICS 313, 314[1]

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–2002.* February 3, 2004. Simon Fraser University.

* Includes light fuel oil (middle distillates) and liquid petroleum gas (propane).

[1] Sum of all NAICS 313 Textile Mills and NAICS 314 Textile Product Mills.

The new North American Industry Classification System (NAICS) classifies textiles producers under Artificial and Synthetic Fibres/Filaments Manufacturing (NAICS 32522), Textile Mills (NAICS 313) and Textile Product Mills (NAICS 314). NAICS Subgroup 32522 includes producers of synthetic fibres and filaments. NAICS Group 313 comprises establishments that are primarily engaged in manufacturing, finishing or processing yarn or fabrics. NAICS Group 314 includes establishments primarily engaged in manufacturing textile products (except clothing) such as carpets, household textiles, etc. Changes to the classification of industries by Statistics Canada from the Standard Industrial Classification (SIC) to NAICS mean that energy data for the synthetic fibre and filament yarn industries are no longer available separately. The statistics contained in this profile cover only NAICS Groups 313 and 314 as described above.

Profile Canada's textile industry produces the fibres, yarns, fabrics and textile articles purchased by users and customers as diverse as automotive manufacturing, clothing, construction, environmental protection, road building and retail. The industry exports just under half of its production.

Actions

Throughout the textiles sector, companies are taking positive steps toward the more efficient use of energy. For example, J.L. de Ball Canada Inc. of Granby, Quebec, has invested $350,000 in energy efficiency projects that will lower its natural gas consumption and reduce GHG emissions by an expected 1574 tonnes of CO_2 per year. The projects, which include equipment automation, the installation of new direct water heaters and more aggressive repair of steam leaks, have an expected payback period of between 12 and 18 months.

Consoltex Inc., with headquarters in Saint-Laurent, Quebec, and four manufacturing plants in Quebec and Ontario, is incorporating energy efficiency activities into its day-to-day operations. Boilers are turned off on weekends to save energy, and the company is raising staff awareness by distributing an employee newsletter that focuses on energy.

Lincoln Fabrics Ltd. of St. Catharines, Ontario, continues to consolidate production using newer, more energy-efficient production equipment, holding older equipment in reserve to use in overflow conditions. The company is also working to improve building insulation and has decided to cover and insulate windows on one side of a building to reduce its heating and cooling load. Lincoln Fabrics is also reconfiguring its second weave room to improve its energy efficiency.

Beaulieu Canada Company of Acton Vale, Quebec, has modified its water heating system, saving the company an estimated $60,000 per year in energy costs.

Doubletex Inc., with plants in Montréal and Toronto, is planning to mix hot wastewater with cooler water at its machines to provide temperature-controlled process water and speed up production. The company also plans to recover heat from dryer exhaust and use it to preheat incoming air. Recently completed energy audits led the company to install two new, more-efficient heat exchangers.

Energy performance contracting at DuPont Canada Inc. has reduced the company's energy usage by a total of 6 percent. Projects completed represent a total investment of about $42 million.

Denim Swift, located in Drummondville, Quebec, has reached an agreement with energy performance contractor Ecosystem to finance nearly $12 million in energy efficiency projects. Under this program, the company has installed a new compressor and an economizer and has begun recovering energy with a new heat pump. To date, Denim Swift has saved over $400,000 in annual energy costs.

Energy efficiency efforts at St. Lawrence Corporation of Iroquois, Ontario, have increased its power factor to an impressive 94 percent. The company has installed high-efficiency motors and has worked hard to increase employee awareness. Company operators have improved the way in which dryers are operated, leading to better heat profiles and productivity increases of 33 percent. St. Lawrence is also installing an integrated sewing machine system that will increase productivity and reduce electricity consumption. Similarly, increasing the fabric width on its looms will enable the company to produce more fabric using the same amount of energy.

Achievements

The textile industry improved its energy intensity by 44 percent between 1995 and 2002. The sector's actual energy use dropped by 39.7 percent during the same period, with a slight increase in the industry's GDP.

The Textiles Sector Task Force remains committed to an energy intensity reduction target of 1 percent per year through 2010. To meet this goal, the industry will build on its significant success in improving energy efficiency in recent years and will continue its ongoing consultations with governments and other stakeholders to help Canada meet its Kyoto Protocol goals.

Challenges

The Textiles Sector Task Force believes that one of its key challenges is to gain the active participation of more of the industry's major producers as Industrial Energy Innovators, and the group is continuing to work toward this end. Increased efforts are required to sensitize companies to the long-term implications of Canada's Kyoto Protocol commitments and to build active participation in Canada's National Implementation Strategy on Climate Change. To make further advances in energy efficiency, companies must be encouraged to adopt benchmarking and best-practices approaches to energy management.

The Textiles Sector Task Force and the Canadian Textiles Institute have devoted significant time and resources to addressing these challenges. The organizations plan to continue to intensify their efforts.

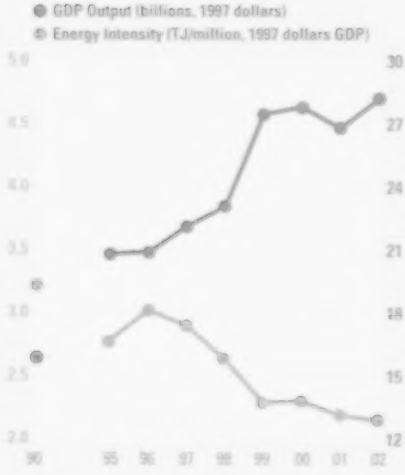
TRANSPORTATION EQUIPMENT MANUFACTURING

Energy intensity
IMPROVES 33%
since 1990

The transportation equipment manufacturing sector's GDP increased by 77.3 percent between 1990 and 2002, and the sector achieved a 33.0 percent improvement in energy intensity.

Transportation Equipment Manufacturing Sector – NAICS 336000

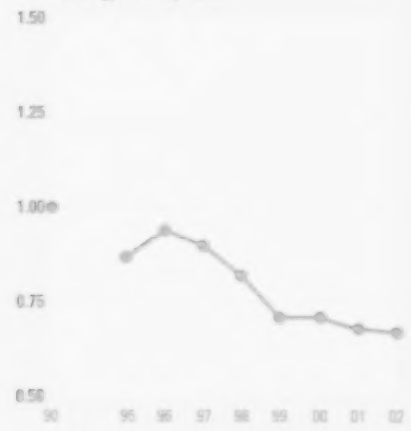
Energy Intensity and Economic Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004, Simon Fraser University.

Transportation Equipment Manufacturing Sector – NAICS 336000

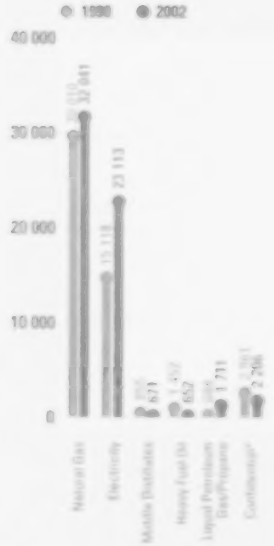
Energy Intensity Index (1990–2002)
Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004, Simon Fraser University.

Transportation Equipment Manufacturing Sector – NAICS 336000

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry 1990–2002*, February 3, 2004, Simon Fraser University.

* Includes coal, coke and steam.

Profile The Canadian transportation equipment manufacturing sector includes companies that manufacture aircraft, aircraft parts, automobiles, motor vehicle parts, trucks, buses, trailers, railroad rolling stock, ships and pleasure boats. The sector is a major part of the Canadian economy, accounting for nearly 3 percent of Canada's GDP and more than 16 percent of the total manufacturing GDP in 2002. Including dealers, parts and distribution networks, the sector employs more than half a million people across Canada.

Actions

Individual members of the transportation equipment manufacturing sector have made significant advances in energy efficiency. For example, Bombardier Inc. implemented a number of energy-saving initiatives, including the installation of a steam plant blow-down heat recovery system, an optimization system for its chiller plant operations, and a new system based on programmable logic controls for the paint shops at the company's site in Toronto, Ontario. The company also replaced old compressors with new, variable speed drive energy-efficient compressors, upgraded HVAC controls and established night set-backs on its air-conditioning systems.

Goodrich Landing Gear of Oakville, Ontario, has reduced its energy consumption by 18 percent since 1997 through energy conservation initiatives that include installing an energy management system, converting a boiler and stress-relief oven from electric to gas, retrofitting lighting, establishing a program to reduce compressed-air use and launching a sub-metering program. Some of the initiatives undertaken between 1997 and 1999 were completed through a highly successful energy performance contract.

Over the last two years, General Motors of Canada Limited has conducted an extensive audit and repair program on steam traps at its truck and car plants in Oshawa, Ontario. To date, almost 2700 steam traps have been identified, and repairs have saved an estimated 95 000 mmBtu. The program has been so successful that GM plans to extend it to other buildings at its car plants in Oshawa.

DaimlerChrysler Canada Inc. established an energy management database in 2003 for the use of all company facilities. The database includes best practices in energy management, an energy manual, energy standards, case studies in energy conservation, and a list of future projects and estimated savings. DaimlerChrysler Canada reduced its overall energy consumption per vehicle produced by 23 percent from 1990 to 2002.

Ford Motor Company of Canada, Limited has improved its energy efficiency by 20 percent since 1995. In 2002, the company updated compressed-air controls, expanded its energy management system, installed additional energy meters, updated lighting controls and made process modifications.

In 2002, Honda of Canada Mfg. completed several energy conservation projects, including converting two bumper-painting processes from steam heat to natural gas, retrofitting lighting in two paint departments, and adjusting the start and stop times of process equipment to reduce off-hours use. Through these projects, Honda reduced its energy consumption per unit produced by 1.3 percent.

Toyota Motor Manufacturing Canada Inc.'s many recent energy-reduction projects include the installation of new air compressor controls, which reduced the energy use of its compressed-air system by approximately 15 percent. In 2002, the company reduced its overall electrical usage by 12.7 percent per unit produced compared with 2001.

In 2002, The Woodbridge Group delivered a customized Dollars to Sense energy training program in 57 locations worldwide and established a company-wide energy reduction goal of 10 percent.

The CIPEC Transportation Equipment Manufacturing Sector Task Force continued its tradition of promoting energy efficiency at its seventh annual energy conference, held at Ford Motor Company of Canada Headquarters in Oakville, Ontario, in 2003. The next annual energy conference is scheduled for the first quarter of 2004.

Achievements

In 2002, the value of the transportation equipment manufacturing sector's total output increased by 5.11 percent, while its energy intensity decreased by 1.8 percent. The sector's energy usage for the year increased by 3.4 percent over 2001, a rate just over half of the increase in the industry's total output. In 2002, the sector consumed 60 394 TJ of energy, up 18.2 percent from 1990. However, over the same period, the sector's GDP increased by 77.3 percent, leading to an overall improvement in energy intensity of 33.0 percent.

The share of energy used by fuel type shows a continuing trend toward higher electricity usage (38.3 percent in 2002) and a lower usage of natural gas (53 percent). Use of liquid petroleum gases, middle distillates (No. 2 fuel oil) and heavy fuel oil has held steady in response to continuing high natural gas prices.

Challenges

The U.S. economy, especially its automotive sector, continues to perform below expected levels. The resulting weakness in sales leads to the under-utilization of facilities, thereby raising energy intensity despite an overall decrease in energy usage. Investment payback requirements of less than two years and internal competition for funds are serious challenges for energy managers seeking to make major gains. Moreover, energy efficiency improvements arising from the implementation of new technologies are likely to be offset by trends that are driving energy use higher. These trends include the increased use of cooling to improve working conditions, more demanding pollution regulations and a shift to more energy intensive products and processes.

Sector companies are already efficient energy users, and there are relatively few cost-effective opportunities for dramatic gains, even under the pressure of higher energy costs. Unless there are major advances in technology, energy efficiency improvements are likely to occur in small increments.

Gas flaring
CUT BY 62%
since 1996

Upstream oil and gas industry expenditures make up 21.4 percent of all capital expenditures on environmental protection in Canada.

The sector is currently working with NRCan's Office of Energy Efficiency to develop indices and figures.

Profile The upstream oil and gas sector includes the companies that find and develop Canada's vast hydrocarbon reserves. Products and services derived from this industry include heating and transportation fuels, building supplies and materials, clothing and vital medicines. The exploration and production industry is represented by the Canadian Association of Petroleum Producers (CAPP) and the Small Explorers and Producers Association of Canada (SEPAC). The member companies of these associations account for more than 99 percent of the crude oil and natural gas produced in Canada and are an important part of a $60-billion-a-year national industry. Canada's upstream oil and gas industry is the nation's single largest private sector investor, with almost $25 billion in capital spending in 2002.

Actions

Through CAPP and SEPAC, Canada's oil and gas producers are committed to environmental stewardship. In fact, Canada's upstream oil and gas industry spends more on environmental protection than any other sector. According to Statistics Canada, 21.4 percent of all capital expenditures on environmental protection in Canada are attributable to the petroleum sector.

CAPP represents a total of 140 companies, which produce 97 percent of Canada's natural gas and crude oil. The 54 member companies that reported benchmarking results for 2002 account for approximately 95 percent of all members' annual production. All member companies will be required to report some data for 2003 and onward.

Stewardship not only helps member companies to improve their corporate citizenship, it also drives internal efficiencies. For example, data collected to benchmark venting put the spotlight on one company's production facilities. Measurement of the company's volumes of vented gas led management to realize that the practice represented lost revenues. A low-pressure gathering system was introduced to increase efficiency, resulting in more gas going through the pipeline than ever before. By managing what it measured, the company has created a solution that is good for the environment and good for the bottom line.

Other sector companies also have active programs to improve energy efficiency. Devon Canada Corporation has implemented hundreds of individual emissions-reduction projects over the past 10 years to control its GHG emissions. As a result, energy use per unit of production for 2002 is 4.4 percent lower than the company's 1994 baseline value. Similarly, GHG emissions per unit of production, i.e., production carbon intensity (PCI), are more than 6 percent lower. Senior management has approved a target of 4035 kilotonnes of CO_2e for 2007, which represents a reduction of 24.5 percent from business-as-usual projections.

BP Canada Energy Company has dramatically reduced natural gas flared during well testing and day-to-day operations, leading to a significant reduction in associated GHG emissions. The company has also focused on increasing the efficiency of its equipment and processes, thus decreasing GHG emissions and energy consumption. BP Canada has begun conducting energy audits and has modified many field compressors to make them more fuel efficient. The company was one of the first to implement a novel zero-emissions technology for powering its field instrumentation.

Energy efficiency projects conducted by Nexen Canada Ltd., based in Calgary, led to GHG emissions reductions throughout its operations. The company's conventional oil business unit built a new facility, equipped with a gas-conservation system, to replace an old facility that had been flaring solution gas, resulting in an annual CO_2e emissions reduction of 4800 tonnes. Nexen's Canadian gas and heavy oil business units also recorded significant improvements in their annual GHG emissions.

Shiningbank Energy Ltd. is now capturing previously flared solution gas and diverting it for use by another company. Shiningbank has also installed two-stage converters on 60 pump-jack engine drivers, thereby reducing fuel consumption by 55 percent. These initiatives enabled the company to reduce GHG emissions by an estimated 1315 tonnes of CO_2e per year in 2002 and 1834 tonnes of CO_2e per year in 2003.

Dominion Exploration Canada Ltd. is conducting a company-wide effort to reduce GHG emissions. Dominion is capturing solution gas for use as a fuel, converting instrumentation to use air instead of natural gas, instituting a comprehensive leak detection and repair program, installing vapour recovery units, and replacing gas-driven pumps with electric-powered alternatives.

Achievements

Solution gas vented from conventional production is down dramatically from 2001, the first year of tracking this measure. Work by Alberta's Clean Air Strategic Alliance, the Alberta Energy and Utilities Board (EUB) and industry members resulted in the publication of *Guide 60: Upstream Petroleum Industry Flaring Guide*. The adoption of procedures outlined in this guide is largely responsible for improved performance for this benchmark. The EUB reported a 16 percent decrease in the practice of flaring and venting gas between 2001 and 2002 and a 62 percent reduction from the 1996 baseline year.

Challenges

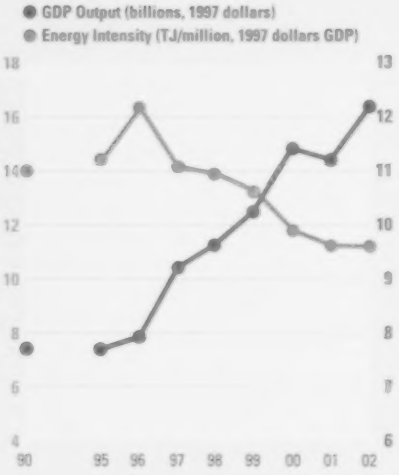
Uncertainty exists regarding the implementation of regulatory mechanisms to manage GHG emissions in Canada. The Government of Alberta is one of the most active provincial jurisdictions in terms of climate change. It has initiated sectoral discussions with large final emitters, which include CAPP members. These activities foreshadow regulatory requirements such as mandatory provincial GHG reporting, which is expected to come into force next year. Both the Alberta government and the Government of Canada reiterated plans to implement a mandatory system during recent GHG consultations in Calgary and Toronto. Although the industry is committed to playing its part in helping Canada meet its international GHG reduction commitments, the long-term impact of legislative and regulatory activities remains a concern for the sector.

Research projects drive EFFICIENCY INNOVATIONS in wood products sector

Canadian companies continue to cut their reliance on natural gas and electricity by turning to cost-effective biomass energy.

Wood Products Manufacturing Sector – NAICS 321000

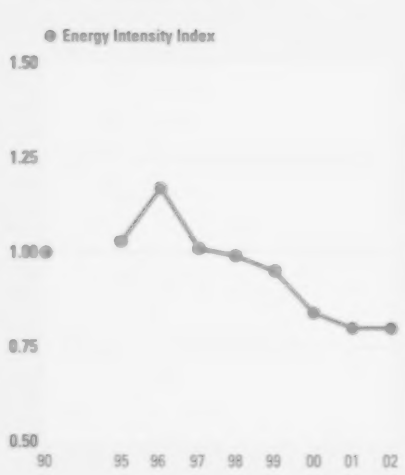
Energy Intensity and Economic Output (1990–2002)



Data source: Canadian Industrial Energy End-Use Data and Centre (CIEEDAC), *Development of Energy Intensity Indicators Analysis for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University

Wood Products Manufacturing Sector – NAICS 321000

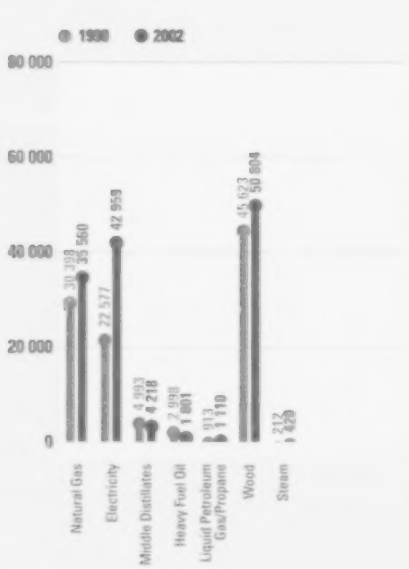
Energy Intensity Index (1990–2002) Base Year 1990 = 1.00



Data source: Canadian Industrial Energy End-Use Data and Centre (CIEEDAC), *Development of Energy Intensity Indicators Analysis for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University

Wood Products Manufacturing Sector – NAICS 321000

Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Centre (CIEEDAC), *Development of Energy Intensity Indicators Analysis for Canadian Industry 1990–2002*. February 3, 2004. Simon Fraser University

Profile The wood products sector includes three industry groups: establishments engaged in sawing logs into lumber and similar products; companies that make products that improve the natural characteristics of wood by manufacturing veneers, plywood, reconstituted wood panel products and engineered wood assemblies; and establishments that make a diverse range of wood products, such as millwork. At the end of 2002, the industry consisted of nearly 3000 establishments across Canada that employed just under 20 000 workers.

Actions

The Canadian wood products sector is an eager and active participant in the search for energy efficiency and the reduction of GHG emissions. On behalf of the industry, and funded by NRCan's Office of Energy Efficiency, Forintek Canada Corp. is conducting an industry-wide study to benchmark energy consumption in each of its major subsectors. The study will be complemented by results from an in-depth study of lumber-drying activities carried out in Quebec. In parallel, Forintek is reviewing international literature to identify the world's best forest industry technology. A final report will be available in 2004.

A demonstration project funded by the Government of Quebec was conducted jointly by Forintek and Hydro-Québec. It focused on electricity-based energy systems, such as vacuum radio-frequency dryers, high-performance heat pumps and a high-pressure, fast-release chamber to dry wood more rapidly and more efficiently. It led to the development of an interesting alternative to heated ponds for thawing logs before winter debarking. Parties are now seeking funding to extend the project to other segments of the industry.

Individual companies are also taking action to improve energy efficiency. Gérard Crête et Fils inc. of Saint-Sévérin, Québec, is experimenting with the use of a heat pump to save energy in its drying kiln. Erie Flooring and Wood Products is working with a group of companies to install a waste-to-energy system at its plant in West Lorne, Ontario. The project will convert wood residue from the Erie Flooring plant into "BioOil." The fuel will be used to drive a power generation system, capable of producing 2.5 megawatts of electricity and 12 000 lb./hr. of steam for Erie Flooring's operations, and provide green power to Ontario's electricity grid. The project is expected to be in operation in the fall of 2004.

Achievements

Canada's wood products sector consumed 136 872 TJ of fossil fuels and electricity in 2002. Although rising production in the sector has driven energy consumption upward, actions taken by companies to boost energy efficiency have also led to substantial improvements in energy intensity.

Recent rises in energy prices will provide a powerful incentive for manufacturers of wood products to implement low-cost energy efficiency measures. Throughout the industry, companies continue to install cost-effective biomass energy systems based on wood waste, displacing the use of costly natural gas and electricity.

Challenges

Compared with many other industrial activities, the fabrication of wood products does not require a lot of energy. Over the years, the industry has replaced expensive energy sources such as oil and natural gas fuels with cheaper, readily available fuels such as bark and wood residues. This has reduced the industry's GHG intensity and reduced the cost of wood residue disposal.

Although the sector's energy consumption per unit of output is relatively low, overall production has continued to increase, and a growing proportion of lumber is dried before delivery. Because most of the sector's wood drying now takes place in Canada, the industry's total energy consumption will likely continue to increase. Moreover, the secondary and tertiary transformation of raw wood into finished products is also growing, and although this has beneficial effects on the Canadian economy, it increases the sector's use of energy. Regular lumber is considered dry at an 18 percent humidity level; lumber used for secondary manufacturing can require levels as low as 6 to 9 percent, thus increasing total energy consumption and the amount of energy consumed per unit of production.

More total demand for energy is now beginning to tighten supplies of by-product fuels such as wood residues and is putting upward pressures on energy costs. This trend is intensifying the industry's interest in energy efficiency.

How CIPEC Works

CIPEC is an umbrella organization overseeing a partnership between government and private industry aimed at improving Canada's industrial energy efficiency. CIPEC comprises sectoral task forces, each of which represents companies engaged in similar industrial activities, that participate through their trade associations. The Task Force Council, with representatives from each CIPEC sector, provides a common forum for sectors to share ideas and recommends ways to address common needs. Overall direction is provided by an Executive Board, which is made up of private sector leaders who are champions of industrial energy efficiency within their sectors and who provide advice on industrial energy efficiency programs and related issues to the Government of Canada.

In the CIPEC partnership, change emerges from consensus and joint action built through open and honest communication. CIPEC continues to be the focal point for industry's response to Canada's climate change efforts. Our role is to promote the evolution of energy efficiency and to recognize and reward those who lead the way.

We carry out this mandate in part through a strong communications and awareness program anchored in our twice-monthly *Heads Up CIPEC* newsletter and in regular features in selected trade magazines. In July 2002, *Heads Up CIPEC* was redesigned as an on-line newsletter. There are now close to 10 000 regular readers of this publication, and its technological transformation has helped to increase traffic on the CIPEC Web site from 32 000 hits per month to more than a quarter of a million.

CIPEC also raises awareness of the goals and benefits of improved energy use in other ways. The Task Force Council and individual sectors are constantly at work to broaden participation, encourage the sharing of information and bolster awareness of the role and achievements of CIPEC industries. The frequency of CIPEC meetings and other gatherings continues to increase, with an average of three CIPEC events occurring per week during the past reporting period.

CIPEC volunteers include successful business leaders and others recognized on the national stage. The profile of these leaders and their strong belief in CIPEC's principles give us a strong edge in attracting new industry participants and in continuing the successful partnership between industry and government.

The Evolution of CIPEC Data

CIPEC sectors in this report are organized in accordance with the North American Industry Classification System (NAICS). NAICS replaces the Standard Industrial Classification (SIC) system used in previous years. The switch was made to bring Canada's classification system in line with Mexico and the United States, its partners in the North American Free Trade Agreement, and involved sub-sector realignment. In addition, the GDP dollar values reported here have been updated to reflect a 1997 base year. CIPEC annual reports for 2000/2001 and earlier were based on a 1986 base year.

Accurate measurement and meaningful data are fundamental to measuring energy efficiency improvements. Data used in this report is collected primarily by Statistics Canada and supplemented by information from associations participating in CIPEC and from other government bodies. The information is interpreted by the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University in Burnaby, British Columbia. CIEEDAC then produces energy intensity indicators for each sector based on production and GDP.

The cooperative CIEEDAC system is internationally recognized for its methodologies, data integrity and cooperation with CIPEC. Primary funding for CIEEDAC comes from NRCan, with additional contributions from industry associations that participate in CIPEC and from the province of Quebec.

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Industrial Energy Innovators

Through NRCan's Office of Energy Efficiency (OEE), the Industrial Energy Innovators initiative focuses on transforming sector-level commitments made by task forces into company-level action by helping to overcome obstacles to energy efficiency at the company level.

As of March 31, 2004, 519 industrial companies from the manufacturing, mining, construction and energy-producing sectors have signed on as Industrial Energy Innovators.

For information on the benefits of becoming an Industrial Energy Innovator, contact the OEE by e-mail at cipec.peeic@nrcan.gc.ca, or visit the Web site at oee.nrcan.gc.ca/cipec.

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Industrial Energy Innovators by Sector

Aluminum
Alcan inc.
Alcoa – Aluminerie de Baie-Comeau
Alcoa – Aluminerie de Bécancour inc.
Alcoa – Aluminerie Deschambault inc.
Aluminerie Alouette inc.

Brewery
Big Rock Brewery Ltd.
Labatt Breweries of Canada
Molson Canada
– Edmonton
– Ontario
Moosehead Breweries Limited
Sleeman Brewing and Malting Co. Ltd.

Cement
ESSROC Canada Inc.
Gordon Shaw Concrete Products Ltd.
Lafarge Canada inc.
Lehigh Inland Cement Limited
Lehigh Northwest Cement Limited
St. Lawrence Cement Inc.
St. Marys Cement Corporation

Chemical
Alcan Chemicals
Benjamin Moore & Co., Limited
Big Quill Resources Inc.
Brenntag Canada Inc.
Chinook Group Limited – Sombra
Degussa Canada Inc.
Huntsman Corporation Canada Inc.
MDS Nordion Inc.
Nacan Products Limited
NOVA Chemicals Corporation
Oxy Vinyls Canada Inc.
Rohm and Haas Canada Inc.
Saskatchewan Minerals

Construction
ATCO Structures Inc.
Indalex Limited
Lockerbie & Hole Industrial Inc.
Northland Building Supplies Ltd.
Wayward Steel Fabricators Ltd.

Dairy
Agrinor Inc. (Laiterie Alma)
Agropur coopérative agro-alimentaire
Amalgamated Dairies Limited
Atwood Cheese Company
Baskin-Robbins Ice Cream
Entreprise Le Mouton Blanc
Foothills Creamery Ltd.
Hewitt's Dairy Limited
Laiterie Chagnon Ltée
Lone Pine Cheese Ltd.
Neilson Dairy Ltd.
Parmalat Dairy & Bakery Inc.
Pine River Cheese & Butter Co-operative
Roman Cheese Products Limited
Salerno Dairy Products Ltd.

Electrical and Electronics
Alstom Canada inc.
ASCO Valve Canada
Broan-NuTone Canada
CAE Inc.
Camco Inc.
Candor Industries Inc.
Century Circuits Inc.
Crest Circuits Inc.
GRM Circuits
Honeywell Limited
IBM Canada Limited
Milpiex Circuits (Canada) Inc.
Nortel
Osram Sylvania Ltd.
PC World
Vansco Electronics Ltd.

Electricity Generation
Ontario Power Generation

Fertilizer
IMC Esterhazy Canada Limited Partnership
IMC Potash Canada Limited
IMC Potash Colonsay ULC
Potash Corporation of Saskatchewan Inc.
– Allan Division
– Cory Division
– Lanigan Division
– New Brunswick Division
– Patience Lake Division
– Rocanville Division

Food and Beverage
ACA Co-operative Limited
Alberta Processing Co. (Division of West Coast Reduction Ltd.)
Aliments Ouimet-Cordon Bleu Inc.
Aliments Reinhart Foods Limited/Ltée
Andrés Wines Ltd.
API Grain Processors
Beta Brands Limited
Better Beef Ltd.
Black Velvet Distilling Company
Burnbrae Farms Limited
Canamera Foods
Canbra Foods Ltd.
Cantor Bakery
Canyon Creek Soup Company Ltd.
Cargill Animal Nutrition
– Camrose
– Lethbridge
Cargill Foods
– High River
– Toronto
Carson Foods
Casco Inc.
Cavendish Farms
Champion Petfoods Ltd.
Coca-Cola Bottling Ltd.
Cold Springs Farm Limited
Connors Bros., Limited
Cuddy Food Products Inc.
Don Chapman Farms Ltd./Lakeview Vegetable Processing Inc.
Eastern Protein Foods Inc.
Effem Inc.
– Bolton
– Newmarket
Family Muffins & Desserts Inc.
Furlani's Food Corporation
Greenview AquaFarm Ltd.
H.J. Heinz Company of Canada Ltd.
Handi Foods Ltd.
Heritage Frozen Foods Ltd.
Hershey Canada Inc.
Hubberts Industries
Kraft Canada Inc.
Legacy Cold Storage Ltd.
Legal Alfalfa Products Ltd.
Les Oeufs-Bec-O inc.
Lilydale Cooperative Ltd.
Lucerne Foods
Maison des Futailles
Maple Leaf Foods Inc.
– Canada Bread Company Ltd.
– Garden Province Meats Inc.
– Landmark Feed Inc.
– Larsen Packers Limited
– Maple Leaf Consumer Foods
– Maple Leaf Pork
– Maple Leaf Poultry
– Rothsay
– Shur-Gain
Maple Lodge Farms Ltd.
Marsan Foods Limited
McCain Foods (Canada)
Mitchell's Gourmet Foods Inc.
Nestlé Canada Inc.
– Midwest Food Products Inc.
Northern Alberta Processing Co.
Oakrun Farm Bakery Ltd.
Okanagan North Growers Cooperative
Olymel
Otter Valley Foods Inc.
Parrish & Heimbecker Limited
Pepsi-Cola Canada Beverages
Prairie Mushrooms (1992) Ltd.
Principality Foods Ltd.
Quality Fast Foods
Sakai Spice (Canada) Corporation
Schenley Distilleries Inc.
Schneider Foods
– Ayr
– Kitchener
– Mississauga
– Port Perry
– Toronto
Sun Valley Foods Canada
Sunny Crunch Foods Ltd.
Sunrise Bakery Ltd.
Sun-Rype Products Ltd.
Sunterra Meats
The Hostess Frito-Lay Company
Town Line Farms/Processing Ltd.
Transfeeder Inc.

Industrial Energy Innovators by Sector (continued)

Food Processing (continued)

Trochu Meat Processors
Trophy Foods Inc.
Unifeed Premix
Unilever Canada
Versacold Group
Vincor International Inc.
Westcan Malting Ltd.
Westglen Milling Ltd.
Weston Foods Inc.
Zinda Products Canada Inc.

Foundry

Ancast Industries Ltd.
Bibby Ste-Croix
Century Pacific Foundry Ltd.
Crowe Foundry Limited
Dana Brake Parts Canada Inc.
Deloro Stellite Inc.
ESCO Limited
– Port Coquitlam
– Port Hope
Gamma Foundries Limited
Grenville Castings Limited
M.A. Steel Foundry Ltd.
Metal Technologies Woodstock Ltd.
Ramsden Industries Limited
Stackpole Limited
Vehcom Manufacturing
Wabi Iron & Steel Corporation
Welland Forge

General Manufacturing

3M Canada Inc.
Acadian Platers Company Limited
Advanced Panel Products Ltd.
Armstrong World Industries Canada Inc.
Avery Dennison Fasson Canada Inc.
BainUltra Inc.
Basin Contracting Limited
Bentofix Technologies Inc.
Canadian Uniform Limited
Cancoil Thermal Corporation
Caraustar Industrial & Consumer Products Group
Carrière Union Ltée
Champion Feed Services Ltd.
Church & Dwight Canada
Climatizer Insulation Inc.
Columbia Industries Limited
Courus s.e.c.
Coyle & Greer Awards Canada Ltd.
Crown Cork & Seal Canada Inc.
Descor Industries Inc.
Dipaolo CNC Retrofit Ltd.
Douglas Barwick Inc.
Eli Lilly Canada Inc.
EMCO Building Products Corp.
– Edmonton
– Pont-Rouge
– Ville LaSalle
Envirogard Products Ltd.
Escalator Handrail Company Inc.
Estée Lauder Cosmetics Ltd.
Euclid-Hitachi Heavy Equipment Ltd.
Federated Co-operatives Limited
Ferraz Shawmut Canada Inc.
Fibrex Insulations Inc.
Garland Commercial Ranges Limited
General Services Inc.
Genfoot Inc.
Greif Containers Inc.
Henkel Canada Corporation, Consumer Adhesives
IKO Industries Ltd.
Imaflex Inc.
Imperial Home Decor Group Canada Inc.
Imperial Tobacco Canada
Imprimerie Interweb inc.
Integria
Interface Flooring Systems (Canada) Inc.
International Paper Industries Limited
J.A. Wilson Display Ltd.
Jones Packaging Inc.
Kindred Industries Ltd.
Kodak Canada Inc.
Korex Canada
Korex Don Valley ULC
Madawaska Doors Inc.
Maksteel Service Centre
Maritime Geothermal Ltd.
Metex Heat Treating Ltd.
Metro Label Company Ltd.
Metroland Printing, Publishing & Distributing
Mondo America Inc.
Montebello Packaging
Nexans Canada Inc.
North American Decal
Norwest Precision Limited
Orica Canada Inc.
Owens Corning Canada Inc.
– Candiac
– Toronto
P. Baillargeon Ltée
Placage Chromex Inc.
Polytainers Inc.
PowerComm Inc.
Procter & Gamble Inc.
– Belleville
– Brockville
PRO-ECO Limited
Rothmans, Benson & Hedges Inc.
Russel Metals Inc.
S.C. Johnson and Son, Limited
Saint-Gobain Ceramic Materials Canada Inc.
Samuel Strapping Systems
Sandvik Materials Technology Canada
Sandvik Tamrock Canada Inc.
Sandvik Tamrock Loaders Inc.
Scapa Tapes North America
Simmons Canada Inc.
Snap-on Tools of Canada Ltd.
Société Laurentide inc.
Soprema inc.
Steelcase Canada Ltd.
Stowe Woodward / Mount Hope Inc.
Suntech Heat Treating Ltd.
Superior Radiant Products Ltd.
Systèmes et Câbles d'Alimentation Pirelli Canada
Teknion Corporation
TekWood
Thermetco Inc.
Transcontinental Interweb Toronto
Tuyaux Wolverine (Canada) inc.
Unifiller Systems Inc.
V.N. Custom Metal Inc.
VA TECH Ferranti-Packard Transformers Ltd.
VicWest Steel
Wabash Alloys Mississauga
Wyeth-Ayerst Canada Inc.
Zenon Environmental Inc.

Lime

Carmeuse Lime (Beachville) Limited
Carmeuse Lime (Dundas) Limited
Carmeuse Lime (Spragge Operations) Limited
Chemical Lime Company of Canada Inc.
Graymont (NB) Inc.
Graymont (QC) inc.
Graymont Western Canada Inc.

Mining

Aur Resources Inc.
Barrick Gold Corporation
BHP Billiton Diamonds Inc.
Boliden Limited
Echo Bay Mines Ltd. – Lupin
Falconbridge Limited
Hillsborough Resources Limited
Hudson Bay Mining & Smelting Co., Limited
Inco Limited
Iron Ore Company of Canada
La Compagnie Minière Québec Cartier
Métallurgie Noranda inc. – Fonderie Horne
Mines Wabush
Newmont Canada Limited –
Golden Giant Mine
Noranda Inc. – Brunswick Mining
Noranda Inc. – Brunswick Smelter
Noranda Inc. – Matagami Mines
Noranda Metallurgy Inc. –
Canadian Copper Refinery
Placer Dome Canada Limited
Sifto Canada Inc.
Syncrude Canada Ltd.
Teck Cominco Limited
Zinc Électrolytique du Canada Ltée

Petroleum Products

Bitumar Inc.
Canadian Tire Petroleum
Chevron Canada Resources
Husky Energy Inc.
Imperial Oil Limited
Irving Oil Limited
Northrock Resources Ltd.
Parkland Refining Ltd.
Penn West Petroleum Ltd.
Petro-Canada
Rider Resources Ltd.
Safety-Kleen Corp.
Shell Canada Limited
Suncor Energy Inc.
Ultramar Ltd.

Plastics

ADS Groupe Composites Inc.
Atlantic Packaging Products Ltd.
Bérou International inc.
D&V Plastics Inc.
Downeast Plastics Ltd.
Husky Injection Molding Systems Ltd.
IPEX Inc.
Kord Products Inc.
Matrix Packaging Inc.
Par-Pak Ltd.
Reid Canada Inc.
Richards Packaging Inc.
Rubbermaid Canada Inc.
Silgan Plastics Canada Inc.
The Clorox Company of Canada, Ltd.
W. Ralston (Canada) Inc.
Winpak Portion Packaging Ltd.

Pulp and Paper

Abitibi-Consolidated Inc.
Bowater Canadian Forest Products Inc.
Caribou Pulp and Paper Company Limited
Cascades Inc.
– Cascades Boxboard Inc.
– Cascades Fine Papers Group Inc.
– Cascades Tissue Group Inc.
Domtar Inc.
Emballages Mitchel-Lincoln Ltée
Emballages Smurfit-Stone Canada inc.
Eurocan Pulp & Paper Company Limited
F.F. Soucy Inc.
Interlake Paper Limited
Kruger Inc.
Lake Utopia Paper
Marathon Pulp Inc.
Maritime Paper Products Limited
New Skeena Forest Products Inc.
Norampac Inc.
NorskeCanada
Papiers Scott Ltée
Papiers Stadacona
Pope & Talbot Ltd.
Smurfit-Stone – Pontiac
St. Anne-Nackawic Pulp Company
St. Marys Paper Ltd.
Stora Enso Port Hawkesbury Ltd.
Stowe Woodward/Mount Hope Inc.
Tembec Paper Group – Spruce Falls Operations
Tolko Manitoba Kraft Paper
UPM-Kymmene Miramichi, Inc.
Weldwood of Canada Limited
West Fraser Timber Co. Ltd.

Rubber

AirBoss Rubber Compounding
Goodyear Canada Inc.
Hamilton Kent Canada Ltd.
Michelin North America (Canada) Inc.
NRI Industries Inc.
Trent Rubber Corp.

Steel

Algoma Steel Inc.
AltaSteel Ltd.
Atlas Specialty Steels
CHT Steel Company Inc.
Dofasco Inc.
Gerdau Ameristeel Corporation
– Cambridge
– Whitby
Ivaco Inc. – Ivaco Rolling Mills
Laurel Steel
Namasco Limited
Norambar inc.
QIT – Fer et Titane inc.
Slater Steel Inc. –
Hamilton Specialty Bar Division
Stelco Hamilton
Stelco Inc.
Stelco Lake Erie
Stelfil Ltée
Stelpipe Ltd.
Stelwire Ltd.

Textiles

Agmont Inc.
Albany International Canada Inc.
Albarrie Canada Limited
American & Efird Canada Inc.
Barrday Inc.
Beaulieu Canada Inc.
Bennett Fleet (Quebec) Inc.
C.S. Brooks Canada Inc.
Cavalier Textiles
Coats Bell
Collingwood Fabrics Inc.
Collins & Aikman Canada Inc.
Colorama Dyeing and Finishing Inc.
Concorde Dyers Inc.
Consoltex Inc.
CookshireTex inc.
Denim Swift
Dentex
Domfoam International Inc.
Doubletex Inc.
DuPont Canada Inc.
Fabrene Inc.
J.L. de Ball Canada Inc.
Jack Spratt Mfg. Inc.
LaGran Canada Inc.
Lainages Victor Ltée
Lanart Rug Inc.
Lincoln Fabrics Ltd.
Manoir Inc.

Industrial Energy Innovators by Sector (continued)

Textiles (continued)

Manufacturier de bas de nylon Doris Ltée
Mondor Ltée
Nova Scotia Textiles, Limited
PGI-DIFCO Tissus de performance Inc.
Spinrite Inc.
St. Lawrence Corporation
Stedfast Inc.
Textiles Monterey (1996) inc.
The Britex Group
The Cambridge Towel Corporation
Tri-Tex Co. Inc.
Velcro Canada Inc.
Vitafoam Products Canada Ltd.
VOA Colfab Inc.
Waterloo Textiles Limited

Transportation Equipment Manufacturing

ABC Group Inc.
– ABC Air Management Systems Inc. (Multi-Flex)
– ABC Climate Control Systems Inc.
– ABC Flexible Engineered Products Inc. (Extrusion)
– ABC Group Exterior Systems
– ABC Group Interior Systems
– ABC Group Product Development
– ABC Metal Products Inc.
– ABC Plastic Moulding – Brydon
– ABC Plastic Moulding – Orlando
– LCF Manufacturing Ltd. – Rexdale
– LCF Manufacturing Ltd. – Weston
– MSB Plastics Manufacturing Ltd.
– PDI Plastics Inc.
– Polybottle Group Limited – Edmonton
– Polybottle Group Limited – Vancouver
– Salflex Polymers Ltd.
– Salga Associates
– Supreme Tooling Group
Accuride Canada Inc.
Active Burgess Mould & Design
Advanced Brake Products Ltd.
Air Canada Technical Services
Boeing Toronto Limited
Bombardier Aerospace
Bombardier Inc.
Cami Automotive Inc.
Canadian General-Tower Limited
Canadian Pacific Railway
DaimlerChrysler Canada Inc.
Dresden Industrial
– Rodney
– Stratford
Dura Automotive Systems (Canada), Ltd.
Dura-Lite Heat Transfer Products Ltd.
DynaPlas Ltd.
Équipement Labrie Ltée
Ford Motor Company of Canada, Limited
Freightliner of Canada Ltd. – Sterling Trucks Division
General Motors of Canada Limited
Honda of Canada Mfg.
Iafrate Machine Works Ltd.
International Truck and Engine Corporation Canada
Lear Corporation
Montupet Ltée
National Steel Car Limited
Niagara Piston Inc.
Oetiker Limited
Orenda Aerospace Corporation
Orion Bus Industries Inc.
Oxford Automotive Inc. – Suspension Division
Polywheels Manufacturing Limited
Pontec Produits Ferroviaires Ltée
Pratt & Whitney Canada Inc.
Presstran Industries
Prévost Car Inc.
Production Paint Stripping Ltd.
R. Reininger & Son Limited
Rockwell Automation Canada Inc.
– Cambridge
– Stratford
Russel Metals Inc. (Ontario)
Siemens VDO Automotive Inc.
Simcoe Parts Service Inc.
The Butcher Engineering Enterprises Limited
Toyota Motor Manufacturing Canada Inc.
TRW Automotive
TS Tech Canada Inc.
Volvo Cars of Canada Ltd.
Woodbridge Foam Corporation

Upstream Oil and Gas

BP Canada Energy Company
ConocoPhillips Canada (North) Limited
Devon Canada Corporation
Enbridge Pipelines Inc.
Husky Oil Operations Ltd.
Keyspan Energy Canada
Newalta Corporation – Airdrie
Nexen Canada Ltd.
Paramount Resources Ltd.
Pengrowth Corporation
Taurus Exploration Ltd.
Trans World Oil & Gas Ltd.

Wood Products

Canfor Corporation
Erie Flooring and Wood Products
Flakeboard Company Limited
Louisiana Pacific Canada Ltd.
Marcel Lauzon Inc.
New Skeena Forest Products Inc. – Terrace
Nexfor Inc.
Riverside Forest Products Limited
Tembec Inc.
Weyerhaeuser Canada Ltd.

Association Members

Aerospace Industries Association of Canada

Alberta Food Processors Association

Aluminium Association of Canada

Automotive Parts Manufacturers' Association

Baking Association of Canada

Brewers of Canada

Canadian Association of Man-Made Vitreous Fibre Manufacturers

Canadian Association of Petroleum Producers

Canadian Chamber of Commerce

Canadian Chemical Producers' Association

Canadian Construction Association

Canadian Council of Grocery Distributors

Canadian Electricity Association

Canadian Fertilizer Institute

Canadian Foundry Association

Canadian Gas Association

Canadian Lime Institute

Canadian Manufacturers & Exporters (CME)

- CME Alberta Division
- CME British Columbia Division
- CME Manitoba Division
- CME New Brunswick Division
- CME Newfoundland Division
- CME Nova Scotia Division
- CME Ontario Division
- CME Prince Edward Island Division

Canadian Meat Council

Canadian Petroleum Products Institute

Canadian Plastics Industry Association

Canadian Steel Environmental Committee (Canadian Steel Producers Association)

Canadian Textiles Institute

Canadian Vehicle Manufacturers' Association

Cement Association of Canada

Council of Forest Industries

Electro-Federation Canada

Fisheries Council of Canada

Food and Consumer Products Manufacturers of Canada

Forest Products Association of Canada

Forintek Canada Corporation

Mining Association of Canada

Ontario Agri Business Association

Ontario Food Producers' Association

Packaging Association of Canada

Québec Forest Industries Association

Rubber Association of Canada

Small Explorers and Producers Association of Canada

Industrial Programs Division Staff

CIPEC Secretariat

CIPEC Secretariat services are provided by industry officers of NRCan's Office of Energy Efficiency. These services provide support to Innovator companies and work with CIPEC task forces to organize meetings, benchmark energy intensity in various sectors, develop energy efficiency guidebooks and deliver workshops.

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Glossary of Terms

Annual Census of Mines
NRCan survey that collects information on NAICS 2122 (Metal Mining) and NAICS 2123 (Non-Metal Mineral Mining and Quarrying). Full name is Annual Census of Mines, Quarries and Sand Pits.

Annual Survey of Manufactures (ASM)
Statistics Canada survey. Provides information on the consumption of purchased fuels and electricity (CPFE) for approximately 230 sub-sectors at four-digit NAICS code levels.

Base Year
A reference year. For the Framework Convention on Climate Change, 1990 is the base year.

Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.)
VCR Inc. encourages the private and public sectors to take voluntary steps to limit or reduce GHG emissions. As a first step, participants are encouraged to submit a letter of intent confirming a commitment to limit or reduce GHGs from their operations. This is followed by an action plan and subsequent progress reports.

Carbon Dioxide (CO_2)
A compound of carbon and oxygen that in its normal gaseous state is clear and colourless. CO_2 is formed whenever carbon-bearing fuels are burned. It can also be formed via other reactions that do not involve combustion.

Carbon Dioxide Equivalent (CO_2e)
A metric measure used to compare the emissions of the different GHGs based upon their global warming potential. Global warming potentials are used to convert GHGs to CO_2e.

Economic Energy Intensity
Energy consumption per unit of economic output.

Embodied Energy
The energy consumed to transform all upstream raw materials into the final product; in a life-cycle approach, it would be the "cradle to grave" energy burden.

Energy Intensity
Energy consumption per unit of output.

Energy Intensity Indicator
A dimensionless ratio equal to the energy intensity in a particular year divided by the energy intensity of the base year. The energy intensity indicator for the base year equals 1.0.

Energy Performance Measures
Any of a variety of metrics that would indicate an aspect of energy performance.

Framework Convention on Climate Change
United Nations convention to address climate change, signed by more than 150 countries at the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992. Canada became the eighth country to ratify the Convention, which entered into force on March 21, 1994, thereby committing to work toward stabilizing GHG emissions at 1990 levels by the year 2000.

Greenhouse Gas (GHG)
A GHG absorbs and radiates heat in the lower atmosphere that otherwise would be lost in space. The greenhouse effect is essential for life on this planet since it keeps average global temperatures high enough to support plant and animal growth. The main GHGs are carbon dioxide (CO_2), methane (CH_4), chlorofluorocarbons (CFCs) and nitrous oxides (N_2O). By far the most abundant GHG is CO_2, accounting for 70 percent of the greenhouse effect.

Gross Domestic Product (GDP)
The total value of goods and services produced by the nation's economy before deduction of depreciation charges and other allowances for capital consumption, labour and property located in Canada. It includes the total output of goods and services by private consumers and government, gross private domestic capital investment and net foreign trade. GDP figures are reported in real 1986 dollars.

Higher Heating Value
The amount of heat that is obtained when a specified amount of fuel is combusted with its stoichiometrically correct amount of air, both being at 15°C when combustion starts, and the products of combustion being cooled to 15°C before the heat release is measured (also called gross calorific value or gross heating value).

Industrial Consumption of Energy Survey (ICE)
Statistics Canada survey on energy use. Covers purchased and non-purchased energy for approximately 24 industrial sub-sectors.

Large Final Emitters
Large final emitters are companies that produce goods in emissions-intensive sectors, including primary energy production, electricity production and selected areas of mining and manufacturing production. The Climate Change Plan for Canada defines sectors as large final emitters using the following criteria:

- annual average emissions of 8 kilotonnes of CO_2e per establishment or more; and
- annual average emissions of 20 kilograms of CO_2e per $1,000 gross production or more.

Large Final Emitters Group
The Large Final Emitters Group of NRCan was established in late 2002 and is responsible for working with key industry sectors to reduce annual GHG emissions. Projections show that large industrial emitters could produce about half of Canada's total GHG emissions by 2010. In accordance with the Climate Change Plan for Canada, large industrial emitters are to reduce their emissions by 55 megatonnes of CO_2e. Through its discussions with industry, provinces and territories and other stakeholders, the Large Final Emitters Group will design policies and measures that encourage reductions of this magnitude, are administratively efficient and clear, and help to maintain the competitiveness of Canadian industry.

Lower Heating Value
The higher heating value minus the latent heat of vaporization of the water vapour formed by the combustion of any hydrogen present in the fuel. For a fuel with no hydrogen, the higher and lower heating values are the same (also called the lower calorific value or the net heating value).

Glossary of Terms (continued)

Natural Resources Canada (NRCan)
The predominant natural resource department of the Government of Canada, NRCan has a mandate to promote the sustainable development and responsible use of Canada's mineral, energy and forestry resources and to develop an understanding of Canada's land mass.

Nitrogen Dioxide (NO_2)
One of a group of gases called nitrogen oxides, which are composed of nitrogen and oxygen. Like sulphur dioxide, nitrogen oxides can react with other chemicals in the atmosphere in the presence of sunlight to form acidic pollutants, including nitric acid.

Nitrogen Oxides (NO_x)
The sum of nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen oxides react with volatile organic compounds in the presence of sunlight to form ground-level ozone.

North American Industry Classification System (NAICS)
A classification system that categorizes establishments into groups with similar economic activities. The structure of NAICS, adopted by Statistics Canada in 1997 to replace the 1980 Standard Industrial Classification (SIC) system, has been developed by the statistical agencies of Canada, Mexico and the United States.

Physical Energy Intensity
Energy consumption per unit of physical output.

Quarterly Report on Energy Supply and Demand (QRESD)
Provides an energy balance of all energy consumption in Canada. QRESD data on the manufacturing industries are gathered principally by the Industrial Consumption of Energy (ICE) survey. This data is supplemented by other surveys on the disposition of energy (from utilities) and the production of petroleum products.

Specific Energy (Consumption)
Energy consumption per physical unit of output (also called physical energy intensity).

Standard Industrial Classification (SIC)
A classification system that categorizes establishments into groups with similar economic activities.

Statistics Canada
Statistics Canada is the country's national statistical agency, with programs organized into three broad subject areas: demographic and social, socio-economic and economic. Under the *Statistics Act*, Statistics Canada is required to collect, compile, analyse, abstract and publish statistical information on virtually every aspect of the nation's society and economy. All information given to Statistics Canada through surveys, the census or any other source is confidential. Statistics Canada does not release any information that identifies an individual or organization.

Sulphur Oxides (SO_x)
A product of combustion of fuels that contain sulphur. SO_x is a major component of acid rain.

Tier I
Informal designation by CIPEC of industries that are major energy-consuming industries. The seven designated Tier I industries are pulp and paper, petroleum refining, cement, mining, steel, chemicals and aluminum. The Tier I industries account for approximately 80 percent of total Canadian industrial energy consumption.

Tier II
Informal designation by CIPEC of industries that are minor energy-consuming industries (relative to Tier I industries) but contribute substantially to Canadian industrial GDP. Tier II industries account for 60 percent of Canadian industrial GDP.

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Leading Canadians to Energy Efficiency at Home, at Work and on the Road

The Office of Energy Efficiency of Natural Resources Canada
strengthens and expands Canada's commitment to energy efficiency
in order to help address the challenges of climate change.

Canada